ROADS AND STREETS

Design, Construction, Maintenance and Traffic Control

H. P. GILLETTE, *Editor*

This Outfit on This Good Road Would Have Signified Rapid Travel Two or Three Decades Ago

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***See the Road and Street Catalog & Data Book**

In addition to the advertising messages to be found in this issue of Roads and Streets on the pages as indicated above, condensed catalogs of those marked * as well as other specifications and construction data will be found in the Road and Street Catalog and Data Book, the 384 page annual reference guide for the highway industries, published by the Gillette Publishing Co.

ROADS AND STREETS

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Mechanical Spreader Applying Stone on Center Strip, U. S. Route 17 in South Carolina

Kerosene Non-Skid Treatment

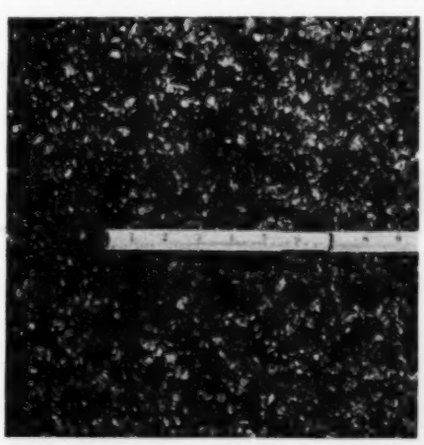
on Asphaltic Concrete Pavements

By W. K. BECKHAM

Maintenance Engineer, South Carolina State Highway Department, Columbia, S. C.

THE Atlantic Coastal Highway (U. S. Route 17 and 217) is paved with asphaltic concrete through Florence County and partly through Dillon County in South Carolina. During the winter of 1929-30 a large column of fast traffic to and from the south, Florida mostly, passed over this pavement. During the wet weather of the winter some sections of this pavement became slippery and it was believed that these could be made safer for the fast traffic if more stone could be embedded in or added to the old surface. To determine the best method of accomplishing this, the state highway department made experiments on approximately 1 mile of pavement in April, 1930.

Experimental Treatments.—In the experiments various grades of cutback asphalts and distillates were used. Heating the stone and heating the pavement prior to applying the stone were also tried. The experimental treatments were applied at times when the temperature of the surrounding atmosphere was between 70 and 80 deg. F.



Close-up on Florence County Project

Treated with 1/13 gal. per sq. yd. of kerosene, 3 lb. limestone chatts. Placed April 22; rolled with 5-ton roller; traffic kept off 3 hours before rolling; air temperature approximately 80 deg. F. Picture taken May 15.

During the month of June, and after several inspections of the experimental section, it was decided that one of the water-white distillate (kerosene) sections would be the best as a nonskid treatment for this particular pavement. The advantages of this treatment were as follows: no additional asphalt was added to the surface; the surface was softened by the slow-evaporating distillate enough to permit ⅜-in. stone being rolled into it and the old asphaltic cement, softened in this way, was sufficiently sticky to hold the new stone very satisfactorily; the treatment was very cheap and easily applied; there were no damaging effects to the pavement.

Materials Used in Kerosene Treatment.—During August, 1930, this treatment was placed on approximately 40 miles of asphaltic concrete pave-

Distributor Applying Kerosene for Non-Skid Treatment

ment in Florence and Dillon counties. The treatment consisted of applying 1/13 gal. of water-white distillate (kerosene) per sq. yd., covering this with 8 lb. of ⅜-in. crushed stone and rolling. Specifications for the material used were as follows:

Distillate

Gravity Baumé	42 min.
Flash point	100 deg. F. min.
Begins to distill at	185 deg. C. max.
Distillate to 200 deg. C.	10% min.
Distillate to 250 deg. C.	80% min.
End point in deg. C., not over	290 deg. C.
Color	water white

Crushed Stone

The crushed stone shall be free from dirt or other objectionable matter; it shall be made from stone having a toughness of not less than 11 and a per cent of wear of not more than 6. It shall meet the following grading requirements:

Size	Per Cent
Passing a ⅜-in. screen (circular opening)	95
Passing a ¼-in. screen (circular opening)	25 to 75
Passing 10-mesh screen, not more than	10

Stone Applied to Both Sides with 7-Ft. Mechanical Spreader

Method of Application.—All dirt and dust were removed from the pavement with a street broom and the water-white distillate (kerosene) was applied with an asphalt distributor at the rate of 1/13 gal. per sq. yd. About 15 minutes after the distillate was applied the crushed stone was placed in the amount of about 8 lb. per sq. yd. This was spread with a mechanical spreader attached to the rear of a 3-ton truck, and it was necessary to make three trips with the spreader to cover the width of the pavement. Rolling began about 15 minutes after the stone was spread, and the stone was rolled at least twice. Usually the rolling was completed in less than two hours.

Some sections were constructed under traffic. After the stone was spread traffic was allowed to travel over the stone. On other sections detours were provided and only local traffic was permitted to drive over the stone. These sections were not opened to traffic until 6 hours after application of the distillate.

The following equipment was used on this job:

2 belt-conveying car unloaders
1 truck-loading conveyor
10 3-ton trucks
3 5-ton rollers
1 8-ton roller
1 1,000-gal. asphalt distributor
1 street broom

With this equipment the treatment was applied at the average rate of about 6 miles per day.

Costs.—At first the average cost of this treatment was about $385 per mile. Later it was reduced to about $300 per mile. The cost was reduced as the maintenance men became more familiar with the equipment and the method of application.

The treatment has now gone through the winter under heavy traffic and is holding up well.

Looking South at Northern Limits of Scranton on Route 17. Non-Skid Treatment 1 Week Old

Repairing Pavement Settlements

Methods and costs of work in Iowa using the new hydraulic-pressure method

By W. H. ROOT

Maintenance Engineer, Iowa State Highway Department, Ames, Iowa

Fig. 1—Poulter Mud Pump for Raising Pavement Slabs

EVERY state having a considerable mileage of pavement encounters to a greater or less degree the problem of repairing pavement settlements. Many of our heavy fills built a few years ago were constructed without rolling because we did not anticipate paving over them for from five to ten years. Then county bonds were voted and it became necessary to pave over them immediately. As a result we have had many settlements on these projects. We have had more settlements on the 2,300 miles of pavement constructed prior to 1930 than we expect to get on pavements constructed after that time because all fills are now being rolled when constructed. However, in our opinion, in spite of every precaution that may be taken, fill settlements will still occur, and no state should be so cocksure of its construction efficiency as to assume that its road system is immune from pavement settlements.

A careful survey of Iowa's 2,317 miles of pavement in the spring of 1930 revealed that there were 326 settlements, 170 of which were classed as safe and 156 reported as dangerous at 40 m. p. h. This is only one dip per 7 miles of pavement but in all it represented nearly 3 miles of settlement that needed attention. Prior to 1930 three general methods of repair have been commonly practiced in the various states.

The Black-Top Method.—The most common method has been the so-called black-top repair. In this method the pavement surface is usually cleaned and a prime coat of bitumen applied. The depression is then built up with pre-mixed or mixed-in-place bituminous concrete, using the largest size of aggregate practicable. This base course is usually covered and feathered out with a course of fine-aggregate bituminous concrete and the resulting surface sealed with a light application of bitumen and sand. This class of repair possesses the following advantages:

1. It can be made quickly.
2. It is comparatively cheap.
3. No special equipment and no skilled labor are required.
4. Traffic is not greatly inconvenienced.
5. If properly done it presents a very satisfactory riding surface.

However, this type of repair has one inherent defect. Black-top patches do not cure pavement settlements; they simply cover up the trouble and in most cases are therefore only a temporary relief.

Jacking and Backfilling Method.—A second method of repair has been the jacking and backfilling process. In this method an attempt has been made to cure the settlement by eliminating the cause. As generally practiced this plan consists of the following operations. A longitudinal trench is dug under each edge of the pavement for practically the full length of the dip. Jacks (usually hydraulic) are placed at intervals along this trench. They must be well supported with timbers. Timbers are also placed between the jacks and the pavement. These jacks provide the force for raising the edges of the pavement. If the pavement is cracked longitudinally or if it has a center joint it is necessary to provide some means of raising the center of the pavement. This is usually done by means of a plank or steel bridge extending from one edge of the pavement to the other. A hook from the center of this bridge is placed through a hole in the pavement at the center-line and force thereby applied to raise the center of the slab at the same time that the edges are raised.

When the slab has been raised to grade (or a little above grade to allow for settlement) the open space under the slab is filled with earth or sand. In doing a considerable amount of this work in Iowa we found that sand blown under the pavement with a cement gun gave the best results.

This type of repair has at least one advantage. The voids under the slab are filled. This decreases the like-

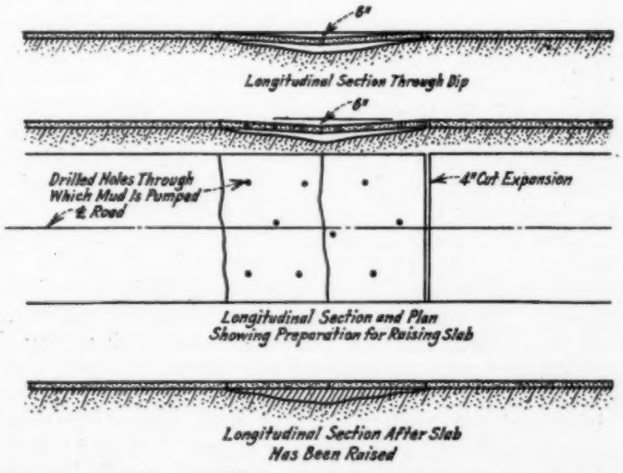


Fig. 2—The Settled Slab, the Slab Prepared for Raising and the Raised Slab

Fig. 3—Mud Pump at Work without Stopping Traffic

lihood of further settlement. On the other hand, this kind of repair has some disadvantages.

1. It is expensive. In raising about 5,000 sq. yd. of pavement in Iowa in 1929 we established an average cost of $1.75 per sq. yd. raised.
2. Traffic must be detoured while repairs are in progress.
3. In case of further settlement additional raising is just as difficult and expensive as the original.

Placing New Slab.—The third plan for repair of pavement settlements which has been in more or less common use is that of breaking out the old slab, rebuilding and rolling the subgrade and then placing a new slab thereon. At first thought this type of repair would seem to be the most permanent of all; however, it is only as permanent as the fill upon which it is placed. Also, it is very expensive (not less than $4 per sq. yd. on the average). Therefore, this type of repair is not feasible except in cases where it is quite evident that no further settlement will take place.

The Hydraulic Pressure Method.—So much for the history of settlement repair. This brings us to the 1930 development of this work.

The engineering profession has long been familiar with the laws of hydraulic pressure and their various applications to engineering problems; however, it remained for John Poulter, a mechanic of the Iowa State Highway Commission, to apply this hydraulic principle to the raising of pavement slabs. For a considerable period of time he experimented with simple home-made devices for producing hydraulic pressure and applying it to slabs. When he had convinced himself that slabs could actually be raised by hydraulic pressure he developed a machine to produce the pressure and applied for a patent on the process of raising slabs by this means.

The first machine used for raising a slab by this method consisted of a tractor valve and valve guide. The guide was grouted in a hole which had been drilled through the slab, mud was poured into the guide and the valve stem inserted. Pressure was produced by the weight of a man standing on the valve.

The Mud Pump.—From this small beginning has been developed the modern Poulter mud pump for raising pavement slabs. This pump is shown in Fig. 1. It is a 2-cylinder reciprocating pump powered by a 20-hp. gasoline engine. It is made up of the following principal parts:

a. Hopper for receiving earth, water and cement.
b. Mixing chamber for mixing the materials.
c. Receiving chamber for holding the mud and delivering it to the cylinders.
d. Pump.
e. Outlet hose.
f. Power plant.

How the Slab Is Raised.—The actual raising of the slab is a simple process. First, a 4-in. expansion is cut across the pavement at one end of the settlement. This is done to prevent a binding action when the slab is raised. Next, 2½-in. holes are drilled through the slab, some near the edge and some near the center joint. The holes are spaced from 4 to 10 ft. apart, depending upon the location of the cracks in the slab. This work is done with the ordinary compressed-air jackhammer and pavement breaker.

Figure 2 shows the settled slab, the slab prepared for raising and the raised slab.

How the Mud Pump Works.—After the slab has been prepared as outlined above, the mud pump is put into operation. Earth is brought to the pump in trucks; black topsoil and loess have proved most satisfactory. Sand wears the cylinders too fast, gravelly soil clogs the valves and heavy clays do not readily form the creamy grout necessary.

Portland cement is added to the earth in the proportion of 1:20. The primary reason for adding cement is to cause the grout to set up quickly after it is pumped. This "setting-up" is not a typical cement set but is an action which produces the same effect as a slight drying out of the mixture. It was early found that under certain conditions the mud pumped in one hole would escape from other holes or from under the edge of the slab and no pressure could be built up. It was found that by waiting for an hour or two the mud would stiffen sufficiently so that pumping could be resumed. The addition of 1 part cement to 20 parts earth has reduced this waiting time from 1 or 2 hours to from 15 to 20 minutes. Laboratory experiments were carried on, using various proportions of lime, cement and plaster of paris, and the 1:20 proportion, using portland cement, was established as the most satisfactory mix. These experiments also showed that the addition of cement greatly reduced the shrinkage. The shrinkage of plain earth and water mixture was found to be 10 per cent, while the shrinkage of the 1:20 mixture was found to be only 3½ per cent.

The hose leading from the pump is a high-pressure 2½-in. fire hose. This is reduced at the outlet to a 2-in. steam hose, which has some elasticity. This outlet hose is placed in the hole in the pavement and when the pump is started the pressure of the mud passing from the 2½-in. hose to the 2-in. outlet expands it and holds it tightly in the hole.

The earth and cement are shoveled from the truck directly into the receiving hopper and water is added. The materials pass from the receiving hopper to the mixing chamber, which resembles the old-style continuous concrete mixer. When the material enters the pump it is a soft grout, the moisture content of which is about 45 per cent. Figure 3 shows the machine at work. Note that traffic is allowed to go through.

No figures are available as to the exact amount of pressure built up by the pump. The weight of the slab, of course, is only about ¾ lb. per sq. in. but fairly high pressures are necessary in order to break the slab loose. Once it starts, little pressure is needed to raise it. Some difficulty has been experienced in starting the slabs but none has been encountered that could not be raised. Some of the older outlet hose has blown out. It is esti-

mated that in some cases a pressure of 50 lb. per sq. in. has been built up.

Results in Iowa.—Iowa has had five mud pumps operating the past season. Some of the slabs which were raised early in the year settled slightly again and the mud pump was brought back and the slabs again raised to grade. The holes in the slab will not be filled permanently until no further settlement is probable.

The average pavement dip during 1930 required 9½ cu. yd. of material for the filling of the voids and the raising of the slab. Inasmuch as the pumps have a capacity of about 1 cu. yd. per hour it takes just about one working day to raise the average settlement. The air-compressor crew, consisting of two men full time and a third man half time, is able to keep ahead of the pumping crew without difficulty.

The fact that a considerable quantity of water is introduced into the subgrade is not considered to be a serious matter. While the mud as pumped has a moisture content of about 45 per cent and while the mud which has been under the pavement for two weeks in the fall of the year still contains about 43 per cent moisture, it is not believed that serious harm will result therefrom. The earth as delivered to the pump has a moisture content about the same as the average subgrade on fills, or approximately 25 per cent.

Fig. 4—Sunken Slab at Railroad Overhead Crossing

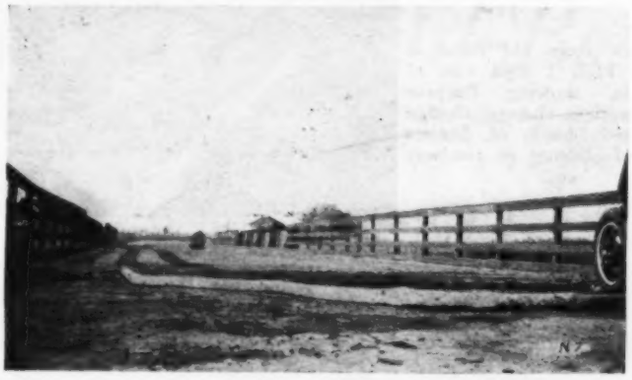


Fig. 5—Raising Sunken Slab

Fig. 6—Completed Operation; Raised Slab Meets Floor Evenly

The figures on the Iowa work are interesting. During the season 200 settlements, comprising 9,292 lin. ft., have been raised from 3 in. to a maximum of 13 in. For this work 1,911 cu. yd. of earth and 2,299 sacks of cement have been used.

The materials have cost $1,580.16, the labor $8,329.08 and the rentals of equipment $8,987.29, making a total cost of $18,896.53. As a total of 18,584 sq. yd. has been raised, the cost has been $1.02 per sq. yd. Also, as a total of 1,911 cu. yd. of earth has been pumped, the cost has been $9.88 per cu. yd. of material pumped. Of the 1,911 cu. yd. of material used, 899 cu. yd, was required to raise the slab to grade. The remaining 1,012 cu. yd. (53 per cent of the total) went to fill the voids under the pavement.

The principal advantages of this mud-pump method of raising pavement settlements are the following:

1. The work can be done quickly.
2. It is not an expensive process.
3. Skilled labor is not required.
4. Traffic does not have to be detoured.
5. It comes nearer to curing the cause than any other method devised.
6. It lends itself readily to additional raising if additional settlement takes place.

Figures 4, 5 and 6 show three stages in the raising of a slab at a railroad overhead crossing. Note the evenness with which the raised slab meets the overhead floor.

It is anticipated that this method can be extended to prevent settlements. Pavements on fills which are expected to settle can be sounded occasionally and if the soundings show voids under the pavement these voids can be pumped full of mud before the pavement settles.

Acknowledgement.—The foregoing is a paper presented at the 17th annual Conference on Highway Engineering at the University of Michigan.

Make a Good Road Better

Wouldn't it pay to reinforce all roads, especially when one considers the 40 to 50 per cent increased useful life? It affords a road of which one may well be proud after a plain job would have been ready for resurfacing or rebuilding.

Every road engineer knows that cracking is the measure of the life of a pavement and without cracks the road would, no doubt, last many times longer. Wire fabric reinforcement reduces cracking and holds to microscopic or small dimensions, those cracks that may occur.

Under conditions such as unfavorable subgrade, unfavorable aggregates, roads over cuts and fills and roads for extremely heavy traffic, it is generally conceded that reinforcement should be used. But this isn't all. Wire fabric reinforcement increases the life of all roads whether built under the best conditions or under the worst conditions. And the additional first cost is comparatively negligible.

The many engineers that have specified wire fabric reinforcement for any length of time for all jobs, unhesitatingly continue to do so. They do this because from actual experience, they find that it pays to such an extent that they can not afford to omit fabric reinforcement from any of their specifications.

Heavy Grading Quantities on a

Pictures from
C. H. BUCKIUS

Construction Engineer, Pennsylvania Department of Highways, Harrisburg, Pa.

TWO projects completed in Pennsylvania during the past year are shown in the accompanying pictures. Heavy grading quantities featured reinforced-concrete construction by R. H. Cunningham & Sons. On the other job, 2-in. oil-bound macadam was placed on a stone base 10 ft. 6 in. wide by the Jones Construction Co. This type of pavement has been found satisfactory in sections of the state where traffic is light.

Looking down on relocation at Charley's Hill from old route. View shows two Bucyrus steamers in roadway cut and one diesel in channel change. Rock loaded in Linn tractor in left foreground is to be used in stone slope wall along south bank of Juniata River, 500 ft. to left of picture.

Right—View looking east over summit of Warrior Ridge, showing concrete pavement undergoing wet-burlap curing process.

Left—View from old route at Charley's Hill, 1 mile east of Alexandria, showing Bucyrus diesel shovel in channel change along north bank of Juniata River and steamer in roadway cut.

Relocation of William Penn Highway in old river bed and widening of channel on left of Frankstown branch of Juniata River, 1 mile east of Alexandria. Three Bucyrus-Erie shovels and one Ingersoll-Rand tripod wagon drill in operation in 30-ft. cut in background.

PENNSYLVANIA

Concrete Highway . . .

Above—Looking west over completed pavement from end of project 2 miles west of Huntingdon, showing highway winding up over eastern slope of Warrior Ridge.

Left—Completed pavement along east slope of Warrior Ridge before cleanup had begun. Town of Huntingdon in background.

. . . and an Oil-Bound Macadam Job

Stone deposited on subgrade before being sledged and knapped to proper size.

Men sledging and knapping stone; crown board in position to check contour of cross-section.

Completed stone base course after it has been knapped and rolled.

Hutchinson River Parkway, Westchester County Park System

Roadside Beautification

A discussion of methods for counteracting roadside defacement and unsightliness within and without the right-of-way boundaries

By JAY DOWNER

Chief Engineer, Westchester County Park Commission, Bronxville, N. Y.

UNTIL recently road builders have concerned themselves wholly with utilitarian aspects. Within the past few years unprecedented mileages of highways and superhighways have been built with little or no thought given to roadside appearances or the effect of such roads upon the abutting lands through which they pass. Construction scars are painfully evident and throughout the country there are many nauseating miles of disfiguring sign-boards, filling stations and hot-dog shacks. The majority of motorists can avoid city slums if they so choose. But on the road they cannot escape the linear slums and sign-boards thrust obtrusively into the field of vision and the privacy of one's thoughts.

The motoring public was temporarily satisfied by the convenience and comfort afforded by the new type of road but now demands that consideration be given to appearances also. In varying degree but practically all over the country the response to this demand is a decided trend toward the conservation of whatever natural beauty exists along the roadsides, its cultivation or creation through landscape treatment, tree and shrub planting, and the exclusion of all forms of man-made ugliness.

The most effective method for counteracting roadside defacement and unsightliness is a subject of widespread discussion. In response to increasing public demand, practical accomplishment has gathered headway and the best methods or means for extending the application of roadside improvement are being seriously studied.

What Can Be Done Within Existing Rights-of-Way.—The improvement of roadside appearances within the publicly owned right-of-way of all highways is a relatively simple matter. This aspect of the problem principally involves neglected opportunities, carelessness and failure to combine some relatively simple principles of artistic design with the purely utilitarian considerations of building and maintaining a serviceable road.

A great deal can be accomplished at relatively small expense within existing rights-of-way beyond closely built city limits, where some excess width outside of pavement margins is available. Along old roads, landscape and forestry work may be advantageously applied. There is a broader field of opportunity along new or rebuilt roads to ameliorate the harsh evidences of their machine-made construction. It is possible to apply some degree of artistry, even in rock blasting, to secure cuts that are not simply crude mutilations. The decent interment of jagged rock fragments in a fill with a coating of topsoil to nourish grass seed or vines yields results out of all proportion to the cost. Incidentally, the practice of depositing valuable topsoil in the bottom of a fill where it is forever lost is a barbaric custom that should be condemned.

Intelligent Forestry Work Now Essential.—Forestry work intelligently applied in the treatment of existing trees, and the planting of young trees, shrubs and vines is becoming one of the recognized essentials of road building. Quite as important as planting is the judicious application of the axe where necessary to open up scenic possibilities for the tourist and, in some sections, to refrain entirely from tree planting. These are matters involving the application of the technique of the landscape

designer whose talent is indispensable to all modern road-building organizations.

In this field, mention should be made of the notable pioneering work of the state of Massachusetts. As far back as 1912 the Massachusetts State Highway Commission assigned one man to the work of tree planting. The work begun in this very modest way has since grown to an important department, the accomplishments of which have added to the renown of Massachusetts wherever roadside beautification is discussed.

The Discordant Pattern.—The most serious phase of the roadside problem overlaps the right-of-way boundaries and extends to the character of the development and utilization of privately-owned abutting property. The modern high-speed highway has brought with it entirely new roadside aspects which nobody could foresee but which are now all too painfully evident.

If we analyze the discordant pattern that unfolds to the motorist over thousands of miles of American highways, we find three principal elements:

1. Sign-boards.
2. Filling stations, hot-dog shanties and roadside markets.
3. Local communities, both residential and trading centers, some of them potential future towns and cities.

These are the predominant phenomena that have mushroomed almost overnight as an outgrowth of the automobile and high-speed highways.

Sign-Boards Now on Defensive.—For the purposes of this discussion we may give the sign-boards short shrift. They are plain intruders—eye-crashers. One of the strongest arguments of space salesmen is that people have to look at sign-boards whether they want to or not. One has to go to some trouble and expense to buy a periodical that contains advertising, but he cannot escape the sign-board. Merited retribution of this philosophy is apparent in public resentment against disfiguring the landscape. The spirit of protest has grown to the point of advocating a boycott against products advertised in this way. Sign-boards have been forced into a defensive battle and have already yielded considerable ground.

Valuable work is being done by agencies such as the National Council for the Protection of Roadside Beauty. Massachusetts has also assumed a leading position in this field in endeavoring to combat the sign-board with practical legislation. If the court tests finally uphold this legislation, the way will be open for all other states to follow.

The Filling-Station Problem.—The second and third of the above-listed classifications are enormously important. The second group furnishes essential accommodations and services to motorists. The economic ramifications of the third are obvious. As to filling stations and roadside service enterprises, any extensive or immediate transformation of existing typical unsightliness under countless diverse and competitive ownerships, is rather hopeless. The crudely improvised filling stations of earlier years have been improved somewhat by the application of better design and neater maintenance at stations built by the large oil companies and chain distributors. Even this type of station, many of them apparently representing fairly large investments of capital, has not evolved very far from the bizarre and garish tradition of the roadside sign-board.

Recreational Areas and Roadside Stopping Places.—Considerable progress is being made under public auspices in extending roadside conservation work to the acquisition and development of recreational areas equipped with essential accommodations for motorists. Automobiles are taking people out to the open country

Bronx Parkway Extension North of Valhalla, Westchester County Park System

in unprecedented numbers. The day-trippers or tourists stopping to eat lunch often find themselves on somebody's front lawn. There are few waste places left within a day's touring radius of all our large cities, particularly in the eastern states. Some place to stop for lunch, to rest and enjoy scenic prospects, a bit of unspoiled woodland, or even to change a tire on land just as public as the road itself, has come to be an essential adjunct of our modern highways. It has been found that a definite policy for providing such places is needed. Temporary stopping places under orderly maintenance are necessary not only to prevent intrusions on private property but for the scenic protection of the countryside.

For some years past Massachusetts has extended its roadside work to cover this need by developing stopping places where there are roadside springs. A similar policy is being followed in many other states. The motive may be to provide a stopping place to conserve a bit of natural beauty or to open up long views on a grand scale. Under present-day conditions, land for public use and enjoyment in excess of the bare requirements for a roadway and its drainage ditches is an essential necessity. Land for these public uses and accommodations can be acquired cheaper now than it ever will be in the future.

The roadside stopping places under public auspices seem to afford the most hopeful opportunities for introducing standards of better taste and improved architecture in the housing of essential accessory accommodations such as filling stations, lunch counters and restaurant facilities.

The final item of discussion is the building growth that gathers along the roadsides to evolve at intervals into

towns and cities. Here we have the important consideration of more-or-less random roadside growth involving not only the esthetics of gas station and other architecture, but curb parking and frequent cross-streets from which flow purely local business and other traffic into a trunk line with the resulting delays, discomforts and accident hazards. One of the most important steps in planning our future towns and cities is to detach their business sections from immediate contact with the highway trunk.

The Westchester County Type of Parkway.—In Westchester County we think that the Westchester type of parkway provides the most satisfactory solution thus far devised for meeting the modern arterial, express highway problem as a whole, which involves not only the movement of traffic, but utilization of abutting lands, which in turn generates the roadside problem.

With infrequent access roadways and grade crossings eliminated at all main thoroughfares, the parkways afford maximum efficiency in traffic movement. There is no roadside problem because we include a slice of the adjoining countryside in the original right-of-way taking for the paved roadway. The roadside problem is forestalled by never laying pavement up to abutting private property. There is always a buffer strip along which we can conserve the native beauties of the countryside or create a synthetic landscape that is so near to the genuine that nobody knows the difference. Nature does most of the work if she is allowed a little space to work in.

Although our parkway reservations are squeezed down in some places to the 250 ft. that we consider a desirable minimum width, visitors have told us that the roadside treatment creates an illusion of riding through an unlimited park.

Parkway Influence on Land Utilization.—In addition to dealing effectively with the problem of roadside control, an inherent element of far-reaching economic importance is the parkway influence on land utilization. In Westchester County all privately-owned lands adjoining the parkway reservations are in demand even at greatly enhanced values, for residential purposes, because they are conveniently close to an arterial motor thoroughfare but separated and screened from it by a strip of grass and trees. Lands in immediate contact with heavily-traveled modern highways are not fit for residential use. The enormous mileages of these frontages created in recent years cannot be absorbed by business and industrial uses. The natural efforts of owners to make them productive in some way leads to sign-boards and the shanty

"The decent interment of jagged rock fragments in a fill with a coating of topsoil to nourish grass seed or vines yields results out of all proportion to the cost. Incidentally, the practice of depositing valuable topsoil in the bottom of a fill where it is forever lost is a barbaric custom that should be condemned."

type of development that constitutes the most serious phase of the roadside problem. Zoning and other restrictive ordinances may help considerably by eliminating sign-boards but cannot wholly dispose of the roadside problem because good taste and architectural standards cannot be enforced by passing laws.

Any comprehensive view of the roadside problem shows that it is not a detached phenomenon but is closely interwoven with traffic movement efficiency and better planned future city and regional growth. The only wholly effective method of dealing with all three of these elements is the complete divorce of the paved roadway from abutting private property.

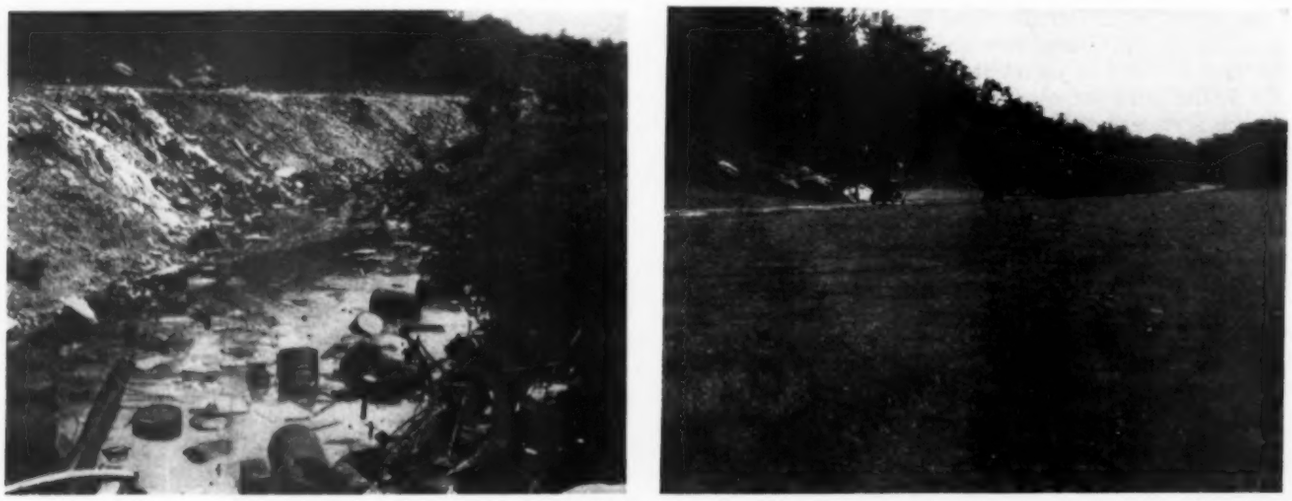
The basic principle of acquiring land in excess of the bare needs of the traveled way is really not so revolutionary as it may seem. It was applied long ago on railroad rights-of-way.

Automobile development has made highways comparable to railroads as far as mechanical operation is concerned. Excess right-of-way for highways makes it possible to exclude the promiscuous entry of traffic at close intervals and provides the land necessary for grade-crossing elimination structures and their access roads or ramps. It wipes out the roadside problem, and in Westchester County the added land cost has been paid many times over by enhanced property valuations.

Conclusions Summarized.—In conclusion we may summarize as follows:

The degree of control over roadside treatment and beautification is predetermined by the type and location of the right-of-way. The first broad principle is adjustment of the highway to the region it serves.

In the suburban residential areas of all large and even medium-sized cities there is a broad field for the application of the excess-right-of-way principle in what we commonly designate as parkways limited to passenger



An Improvement on the Westchester County Park System. Left—Garbage Dump at Yonkers Ave. before Improvement. Right—Saw Mill River Parkway on Site of Former Dump

West St. Bridge, Hutchinson River Parkway, Westchester County Park System

traffic. This type of arterial thoroughfare affords the fullest degree of control over roadside treatment. The fact that there are liberal margins of landscape between the rush and hum of steadily streaming traffic and the nearest privately-owned property enhances rather than depreciates land values.

In sparsely-populated, wide open, level regions excess right-of-way beyond reasonably liberal shoulders and drainage ditches is not required and in general cannot be financed. The requirements in such regions can be met if the abutting lands can be protected against unsightly encroachments. Such protection depends upon zoning or restrictive ordinances against billboards and the maintenance of set-back lines and whether or not such ordidances are upheld by the courts.

Trunk highways largely devoted to motor trucks and mixed business traffic do not require parkway treatment but in residential areas they should be flanked by the widest practicable right-of-way margins or located where their depreciating influence on residential property values will be minimized.

The beautification of the parkway type of thoroughfare is a relatively simple matter for landscape architects trained in that work.

The conventional type of highway presents more difficult problems. The controlling ideal should be to mould the highway unobtrusively into the natural landscape of the region traversed. Many of the probems of roadside treatment are eliminated by the proper adjustment of alignment and grades to the topography. Side slopes should be merged with the natural topography. Tree and shrub planting should be accomplished so that it becomes a part of the adjoining natural growths wherever possible.

Roadside beautification is not synonymous with trees and bushes in monotonous, stereotyped repetition. To attain completely harmonious results careful attention should be given to the design of all accessory structures and appurtenances such as bridges, culverts, guard-rails, direction signs and the location of pole lines. It is apparent that beautification work cannot follow any fixed formula. In the rolling country of our eastern states, a continually changing treatment is required to follow nature's own interesting diversity.

"The roadside stopping places under public auspices seem to afford the most hopeful opportunities for introducing standards of better taste and improved architecture in the housing of essential accessory accommodations such as filling stations, lunch counters and restaurant facilities."

One of the most illuminating discussions that has yet appeared on this phase of the subject is the paper entitled "Highway Beautification," presented to the American Society of Civil Engineers in December, 1929, by James H. Taylor, highway landscape supervisor of the Massachusetts State Highway Commission.

The foregoing conclusions relate to entirely new routes or radical reconstruction operations on existing highways. In many hill-country sections it may be desirable to leave the narrow, crooked, old roads entirely undisturbed. The widening and modernization of these roads involves the mutilation of ancient trees, stone walls and entrance gates toned into the landscape under the mellowing influences of time and weather. The possibilities of saving these picturesque by-ways for the enjoyment of their neighborhood inhabitants should not be overlooked. They can be saved by diverting through traffic to new routes on modern alignment and grades through undeveloped territory.

Acknowledgement.—The foregoing is an abstract of a paper presented Feb. 18 at the 7th annual convention of the Association of Highway Officials of the North Atlantic States.

ROAD MILEAGE AND AREA.—Interesting comparisons of the status of road construction and usage are afforded by figures compiled by the Department of Commerce, Automotive division.

As against the United States area of 1 square mile to each mile of road, improved and unimproved, Spanish Guinea has 1,003.60 square miles, Arabia has 947.86, Tripolitania has 878.05, Alaska has 310.66, Siam has 306.03 and British Guinea has 275.32.

Smaller areas per mile of roads are shown by several nations, and the honors in this class go to Japan, with 0.30 square miles of area to each mile of road, and Gibraltar, which has 15 miles of roads and 2 square miles of area, or a percentage of 0.13.

Latest Developments in the Use of

Tar *for* Highway Surfaces

A discussion of mixed-in-place construction, drag-surface treatments and the use of pre-mixed materials for resurfacing, new paving, shoulder widening and other purposes

By W. L. MASON

Road Engineer, Tarmac Department, Koppers Products Co., Pittsburgh, Pa.

A NUMBER of general methods of using tar have been in existence for some time, so that more-or-less standard construction practices have been developed. I do not intend to go into details of these standard practices but rather to discuss new developments that have come under my observation.

The system of state and county highways of the state of New York, as of January 1, 1930, was 82,272 miles. The improved mileage on the state system is 11,345 miles. The town and county improved mileage is 22,074 miles, leaving 48,853 miles of unimproved roads in New York state.

This unimproved mileage is being given considerable attention at the present time. Highway officials are planning improvements of these roads by the stage construction method. Grades and alignments on unimproved roads are being corrected, with the idea of surfacing them as soon as possible with that type of bituminous surface most suitable for the particular traffic requirements of the highway.

In some instances in the past, low-cost types have been built on main highways where the heavy requirements of traffic actually justified greater expenditures. This was caused, of course, by lack of funds available for the tremendous amount of mileage to be surfaced. When these types proved inadequate on heavy-traffic roads, there was a strong tendency on the part of highway officials to go to the other extreme and build expensive types of construction, regardless of the fact that on some of the highways traffic was so light that these expensive types were not justified. The most recent trend, and one which has only developed in the past two or three years, has been toward a sane planning of highway expenditures so that each official balanced his highway program with regard to the money spent on various classes of roads, as well as to the amount spent for new construction, against that spent for maintenance and repair. By using lower-cost types of construction, officials have been enabled with the same funds to surface a greater mileage without increasing their budgets, and it is thus the building of highways has been placed on a sound business basis.

The so called low-cost types have also been brought to the fore more within the past year or two, because the traveling public is demanding that local roads, as well as main trunk highways, be surfaced. These requirements necessitated a wider disbursement of available funds.

With these things in mind, I am going to classify some of the bituminous surfaces and briefly describe developments in each class.

Single Bituminous Surface Treatment.—The single bituminous surface treatment is so simple, and has been used so widely, that I shall give it only slight mention. However, there is one feature to bring out in this connection, and that is, that on this type of work it is most advantageous to drag the surface after the covering material has been applied. In this manner the stone is turned over and mixed with the tar, is spread uniformly over the surface of the road, and, by filling minor depressions, gives a much smoother riding surface than is the case if dragging is omitted. Also, if the drag method is employed it makes the surface treatment set up faster and reduces the tendency of covering material to kick off the road surface.

Dual Bituminous Surface Treatment.—The dual bituminous surface treatment has been used extensively and to a very good advantage on the treatment of macadam, gravel, top soil and sand-clay roads. It consists of approximately ¼ to ⅛ gal. per sq. yd. of a light grade of prime-coat tar, 8 to 13 specific viscosity, followed with approximtaely ⅛ gal. of heavier tar and covered with approximately 35 lb. per sq. yd. of chips, after which it is rolled. The prime coat penetrates the highway surface from ¼ to 1 in. and forms a perfect bond with the application of heavier tar to follow. After the covering material is spread, dragging and rolling continue as in the single treatment. The advantage of this dragging cannot be minimized, as it helps considerably to smooth up the surface where slight settlements have taken place, making this type of highway particularly smooth-riding for high-speed traffic.

Mixed-in-Place, Retread or Mulched Bituminous Surface.—This type of surfacing is perhaps the one receiving the greatest attention in New York and other states for low-cost wearing surfaces. The demand for such surfaces became so great in New York that in 1929 the state legislature appropriated $100,000 to be used by the department of public works for experimentation with this class of bituminous surface. One mile was built in each

CLASSIFICATION OF BITUMINOUS SURFACES

Description of Types	Cost per Mile	Traffic Capacity in Ave. Vehicles per Day
Single bituminous surface treatment	$ 600—$1,000	600—1,000
Dual bituminous surface treatment	$1,300—$3,000	1,000—1,500
Mixed-in-place or mulch type bituminous surface	$2,200—$4,500	1,000 and up
Bituminous macadam (binder penetration)	$9,000—$15,000	1,000 and up
Pre-mixed bituminous surface laid cold	$7,000—$12,000	1,000 and up

district of the state highway system during the past year, several different types of construction and materials being used.

I wish to describe briefly one mile of road 12 ft. wide, built in the Binghamton district. This road is known as the Patterson Creek experimental road and is in the town of Union, Broome County. This mile of dirt road was chosen as an average dirt road in this district. It was graded, 3,000 yd. of earth was removed and a creek-run gravel base of 12 in. in depth was laid in two 6-in. layers loose for a foundation course. This base was thoroughly rolled and compacted and given a prime application of ¼ gal. per sq. yd. of light tar. A 2½-in. course of run-of-bank gravel was then laid on this foundation. The gravel above 1½ in. was raked out. An analysis of the gravel taken at various times showed 48 per cent passing a ¼-in. screen and about 1 per cent loam. After placing this gravel on the foundation, a ½-gal. application of tar per sq. yd. was used. The surface was then bladed back and forth as in mixed-in-place construction, thoroughly mixing the gravel particles with tar. After two days' mixing, another ¼ gal. per sq. yd. of tar was added and the blading and mixing continued until the mixture began to stiffen, when it was levelled out and rolled. This was then given a seal coat of ¼ gal. of tar per sq. yd.

The cost of this job is as follows:

Cost of grading including slopes and ditches	$1,694.00
Foundation course; 6-mile haul from pit to job	2,717.00
Top course	2,806.00
Trimming shoulders and miscellaneous	452.00
Total cost	$7,669.00

The New York State Highway Department during 1930 built on their state system 95 miles of mixed-in-place construction using crushed stone and tar, the work being done by their maintenance forces, over old penetration macadam or waterbound roads. During 1931 New York state is estimating to continue further with the construction of this mixed-in-place type.

I would like here to give you the data on a mixed-in-place resurface top in Oneida County, built over an old waterbound surface treated road, the work being done by state maintenance forces and equipment. This old waterbound macadam road was widened to 18 ft. and a surface constructed over the full 18 ft., for a distance of 2.54 miles. Limestone and tar were used for the materials. The labor cost per square yard of finished surface 2½ in. thick, was 13½ ct., the stone cost 19 ct. and the tar was 17 ct., a total of 49½ ct. per square yard.

The major advantages in the mixed-in-place type of surface, can be summarized as follows:

1. An extremely smooth-riding surface is obtained by mixed-in-place construction, due to setting-up of the surface under the dragging process and due also to the ability to work about 1,800 lineal ft. of roadway in continuous trips of a power grader.
2. Without interrupting traffic, it builds a closed surface that resembles in structure penetration macadam.
3. It furnishes a skid-proof riding surface.
4. It is low in construction costs due to elimination of hand labor. The use of machinery keeps the cost down to approximately 35 to 50 ct. per sq. yd.
5. It furnishes a thicker bituminous surface than a surface treatment without going into the more expensive penetration or pre-mixed types.
6. As a result of machine methods, more rapid construction is possible than on any other type of pavement, particularly on large projects; as much as 1 mile of finished surface per day for consecutive days has been built.

Bituminous Macadam (Binder Penetration.)—The so called bituminous macadam penetration pavement was officially recognized as a pavement in 1912 by the Association for Standardizing Paving Specifications. Their definition was "The bituminous macadam pavement consists of crushed stone and bituminous material incorporated together by penetration methods." The design of this type of pavement since its inception has been changed only in detail and not in basic principle up to within the last two years. Today variations in the penetration type are briefly:

1. Those producing a rough texture surface, like the Massachusetts type.
2. Variations in seal coat. One seal-coat variation has been brought about by the so called pre-mixed bituminous surfaces laid cold, which consists mainly of an intimate mixture of aggregates and bitumen at a central mixing plant.

The outstanding change from the usual practice of building a penetration macadam pavement is that, instead of liquid tar and chips being used for the seal coat, a layer of pre-mixed material is laid and rolled for the seal coat. The procedure for this type of pavement is exactly the same as in the past up to the point where the choke stone is applied and rolled into the penetration application. After the penetration coat has been thoroughly filled and rolled, all loose choke stone is broomed off and the seal coat of pre-mixed material is spread through mechanical spreaders or from dumping boards in a uniform layer to a depth of 1 to 1½ in. loose, so as to cover the underlying bottom course and fill all voids therein. This is then rolled until all roller marks disappear and the surface shows no further compressibility. The cost of this seal coat varies from 30 to 50 ct. per sq. yd. of finished surface.

Another method of seal which has been called to my attention and which is being specified by the Ohio Department of Highways, consists of a double seal coat. The first seal coat is the usual hot bituminous material and the second seal coat a cold-application material—35-50 specific viscosity at 40 deg. C. and applied at the rate of 0.4 gal. per sq. yd. The unusual feature of this seal is that after the pavement has been swept, three-fourths of the chips required for the final seal coat are cast evenly over the pavement. Then tar for the final seal coat is applied, then the final one-quarter of the chips is immediately applied and dragged with an approved blading drag. After the proper dragging, the surface is rolled while the tar is plastic until the chips are thoroughly embedded. The dragging again plays an important factor in taking out the slight irregularities in the penetration course.

Pre-Mixed Bituminous Surface Laid Cold.—On the whole, the development of pre-mixed surfaces has been rather rapid within the last year or two, and I therefore feel that it is appropriate to discuss this type of surface, although it is more expensive and a higher type of pavement than those previously described. New York state is using this type of surface quite extensively for resurfacing old concrete pavements and for wearing surfaces on new concrete and broken stone bases, also for widening old roads and cold-patch work.

This type of surface is laid within forms, 2 in. in thickness compacted, and in two courses, the course mix or intermediate mix, covered with a sufficient amount of fine mix to fill the surface voids thoroughly and give a uniform appearance to the surface.

In general, the laying of this pavement is as follows:

1. The base course shall have been cleared of all loose and foreign materials.

2. The course mix is spread uniformly by suitable means in a loose layer about 2 in. thick.

3. This material is then rolled and any depressions are filled immediately with additional bottom-course mixture and again rolled until the surface is brought to the proper grade and cross-section.

4. The top-course material is then spread over the bottom course as described in the seal coat for penetration macadam.

The mixing of this type of pavement is done in a scientifically constructed central mixing plant of the pugmill mixer type. The aggregate is screened for the proper gradation, heated and dried, separating out the dust, before going to storage mixing bins. This aggregate is then fed, at the proper mixing temperature, into the mixer and the bitumen added and properly mixed. This mixture is then hauled by dump trucks on to the work or shipped in open-top cars to the destination, where it is unloaded and hauled on the job and spread.

The material is usually made in two grades: the intermediate mix consisting of 1¼ to ¾-in. stone with 10 to 35 per cent passing a ¾-in. sieve, and the fine mix of ⅛ to ½-in. stone. A certain percentage of stone filler is added to the fine mix. All mixtures are proportioned by weight using calibrated scales and all ingredients of mixtures are accurately weighed for each batch.

Most of the state highway departments have included this type of pavement in their specifications, and are allowing an optional specification, making optional with the contractor, the regular 3-in. penetration macadam surface or a 2-in. pre-mixed surface at the same bid price. This is particularly adaptable to new bridge approaches installed on previously constructed pavements.

During 1930 in New York state, a mechanical finishing machine was used in the construction of both courses of this pavement and proved very satisfactory. However, New York does not require a finishing machine in the standard state specifications. By the use of one, a very smooth-riding surface was obtained and the labor cost of laying was greatly reduced, as well as the increased yardage laid over the hand-raking method. The ability of hand rakers or of the finishing machine has been the secret of getting smooth-riding pre-mixed surfaces.

I would like to give a few costs of this type of pavement in New York state, both laying under contract and with maintenance forces.

The advantages of this pre-mixed type of pavement are as follows:

1. Being able to lay and finish one side of the pavement, therefore preventing interruption of traffic.

COST OF PRE-MIXED BITUMINOUS SURFACES

By Contract

County	Length, Miles	Width, Ft.	Thickness, In.	Tons or Yards	Cost per Sq. Yd.
R. C. 1811	17.29	16	2	22,662	$0.95
R. C. 1819	3.26	16	2	5,201	1.30

By Maintenance Force

County	Length, Miles	Width, Ft.	Thickness, In.	Tons or Yards	Cost per Sq. Yd.
Franklin	0.49	14	½ to 1	280	$0.80
Franklin	0.33	16	½ to 1	220	0.80
Columbia	0.6	18	1	500	1.02
Ulster	0.47	20	1	447	0.90
Oneida	2.97	6	½	390	0.45
Madison	1.46	7½	½	195	0.47
Monroe	0.52	17	2	522	1.30
Chautauqua	0.6	17	2½	5,396 sq. yd.*	0.83

*Cold patch mixed on side of road.

2. The uniform density of material due to the proper gradation of aggregates and the close regulation of the batch mixes.

3. The elimination of all dirt and foreign matter in aggregate, as well as having the aggregate at the proper temperature when it receives the bitumen.

4. Having the aggregate thoroughly coated with the proper percentage of bitumen.

5. Being able to add to or remove any material as the construction progresses.

In conclusion let me say that I believe that the most important developments in the use of tar for highway surfaces at the present time are in the order named:

1. Mixed-in-place construction, using gravel, stone or slag aggregate.

2. Drag surface treatments; that is, setting up the surface of medium viscosity surface treatments under dragging action.

3. The use of pre-mixed materials for resurfacing, new paving, shoulder widening and other methods where this convenient material can be used.

4. Development of new grades of tar to fill the requirements for these new types of construction.

Acknowledgement.—The above is a paper presented at the convention of the Association of Highway Officials of North Atlantic States held in Atlantic City, N. J., Feb. 18, 19 and 20.

One Motor Car for Every 4.23 Persons

According to figures compiled by the American Motorists' Association there is one automobile for each 4.23 persons in the United States. The figures are based upon total motor vehicle registrations of the United States compared with the revised 1930 census figures officially announced by the U. S. Census Bureau on Nov. 22, as being 120,623,993, exclusive of census figures of Porto Rico, Hawaii and other foreign possessions.

The population per motor vehicle in 1929 was 5.3 persons per car, the computation being based upon 1920 official census figures, plus an estimated increase in population between 1920 and 1929.

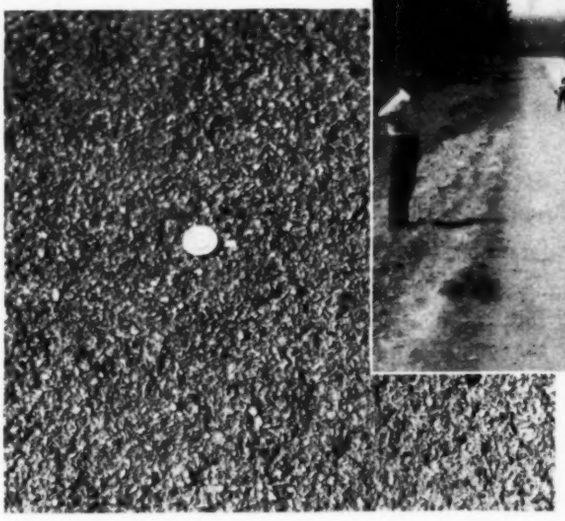
Following are the association's figures, showing the 1930 population per motor vehicle in each state:

State	Pop. Per Car	State	Pop. Per Car
Arizona	3.25	Massachusetts	4.67
Alabama	8.77	North Carolina	6.30
Arkansas	7.37	Nebraska	3.09
Colorado	3.21	North Dakota	3.36
California	2.64	New Jersey	4.45
Connecticut	4.63	New Hampshire	4.04
District of Columbia	2.76	New Mexico	4.65
Delaware	3.88	New York	5.15
Florida	4.24	Nevada	2.49
Georgia	7.29	Oklahoma	3.93
Illinois	4.42	Oregon	3.28
Indiana	3.56	Ohio	3.52
Iowa	2.95	Pennsylvania	5.28
Idaho	3.47	Rhode Island	4.83
Kansas	2.99	South Carolina	7.07
Kentucky	7.23	South Dakota	3.19
Louisiana	7.06	Texas	3.93
Michigan	3.14	Tennessee	6.00
Missouri	4.53	Utah	4.00
Minnesota	3.25	Virginia	5.85
Maryland	4.60	Vermont	3.60
Mississippi	7.91	Washington	3.24
Maine	4.06	West Virginia	6.04
Montana	3.47	Wisconsin	3.59
		Wyoming	3.46

BITUMINOUS MACADAM

Right—Spreading, Hand-Spotting and Rolling, Oregon Multiple-Lift Bituminous Macadam Construction

Below—Close-Up of Bituminous Macadam Surface, Showing Non-Skid Texture



Construction in OREGON

By R. H. BALDOCK
Assistant State Highway Engineer, Salem, Ore.

Methods and costs of constructing the Oregon multiple-lift type of wearing surface—Smooth serviceable surface secured—Oregon specifications for bituminous macadam construction

ROAD oiling began in an experimental way in Oregon in 1923. The first treatments were in the nature of dust palliatives using light fuel oils having an asphalt base. Gradually the more stable surface treatments were evolved, using heavy road oils and high penetration asphalts which have given excellent service. During more recent years, investigations of the use of heavier types involving the construction of bituminous macadams have been carried on, primarily for those roads carrying a large traffic.

About six years ago the writer began an investigation of bituminous macadam construction, which finally culminated in a specification which we termed "multiple-lift," and which has given very satisfactory service. The multiple-lift specifications may be briefly described as a process of constructing bituminous macadam by placing the rock and asphalt in alternate layers, using machines to spread the stone. This method insures the more even coating of the stone by the asphaltic cement and results in a very smooth-riding surface. The freedom from roughness is due to the even distribution from the spreader boxes attached to the hauling trucks and to the repeated smoothing of each layer or lift of stone with long-wheel-base motor graders. The size of the stone, the number of layers and the amount of asphalt used depend upon the thickness of the wearing surface desired, which varies from 1½ to 3 in. compacted in accordance with the amount of traffic.

Oregon is fortunate in having great quantities of hard trap rock, which locks under the roller without undue breaking or chipping, and we have found that with it we can construct a very stable type of wearing course by the multiple-lift method at a very reasonable expenditure.

Foundations and Drainage.—As a preliminary to the construction of any of the types of oiled macadam roads, it is essential that proper drainage and adequate foundations be provided, without which no type of oiled macadam will be successful. The depth of the foundation should be varied in accordance with the strength of the subgrade, which, after all, must bear the load. A survey of subgrade conditions and the proper treatment of the various soils is a problem that is generally overlooked and one that receives scant consideration by many highway engineers. The draining of the water from springs should be performed during grading operations. Many times poor shooting in rock cuts results in the formation of pockets which hold water and cause trouble to oiled surfaces.

Foundations can be constructed quite cheaply by the use of run-of-bank gravel and talus. This can be done to a very good advantage at the time the road is graded by hauling selected material to cover the top of all earth grades. Prices have been secured in this state for such construction ranging from 35 ct. to $1 per cu. yd. in place

Left—Sweeping Roadway. Right—Laying Base Course of 2 to 1½-In. Coarse Aggregate, Showing Action of Spreader Box

inclusive of hauling. In this manner a very stable foundation can be secured at a low price.

Gravel or Macadam Bases.—The next procedure in the construction of an oiled macadam is the placing of the gravel or broken-stone base. Where broken stone of suitable character can be economically obtained, we prefer to construct a waterbound macadam base. If talus or run-of-bank gravel is available for the construction of a foundation course ranging from 6 to 12 in. in compacted thickness, 3 in. of the waterbound macadam construction is sufficient. The base is generally covered by a surface treatment of heavy road oil and screenings, which is maintained for a year or so until the settlements have occurred, the weak spots have developed and all such irregularities have been patched out.

Preparing Macadam Base for Multiple-Lift.—The multiple-lift bituminous macadam wearing surface may be laid on an oiled macadam or an unoiled macadam base. If the base has been previously oiled, it is patched and repaired as necessary to bring it to a smooth and easy-riding surface. Patches are made by the penetration method, using graded stone and Grade E asphalt or 95 per cent road oil. The large patches are compacted by power rolling and the small patches are hand-tamped. The base is swept clean immediately before the first application of asphalt.

An unoiled macadam is shaped to uniform grade and cross-section. If badly pot-holed, it is scarified and reshaped, sprinkled and dragged until smooth and compacted. In this connection, water should be used sparingly and the base should be allowed to dry out thoroughly before any asphalt is applied. Finally all loose material is bladed off, and the surface swept with a power broom until it shows a well-bound mosaic appearance.

Multiple-Lift Construction.—A tack coat of asphalt is then spread, followed immediately by a spread of base rock. Spreader boxes are used on the trucks to obtain an even distribution of the rock, and the surface is trued up by means of long-wheelbase motor graders acting as strike boards. Following this operation, stone is added or removed by hand as is necessary to get a true and even crown and cross-section. The surface is again leveled up by the motor graders and lightly rolled, after which tests are made with a 10-ft. straightedge, the requirement being that it shall not show a variation of more than ¼ in. from the true surface. This may seem to be a rather stringent requirement for macadam construction, but experience has shown that by using the long-wheelbase motor graders this specification is easily satisfied in actual practice with ordinary care. This course is then rolled until the rock is thoroughly locked.

A second application of asphalt is then made, followed by another lift of base rock, or of key rock, depending on the required thickness of the finished work. This and following courses of rock are spread, hand-spotted, trued up and rolled as before, and asphalt is applied between each course of rock.

The seal coat is placed in two applications. The first is placed immediately after the key rock has been rolled, and consists of a spread of asphalt and a covering of ½ to ⅛-in. screenings which are broomed and rolled. After this surface has had traffic for a week or ten days the final seal is applied, consisting of another spread of asphalt and cover stone.

The usual practice is to lay the road half-width at a time, in sections as long as may be completed for the full width in a day's time. One-way traffic is piloted through the construction work by flagmen and a pilot car to avoid any possibility of cars getting into the fresh asphalt or colliding with the machinery.

In most of this bituminous macadam construction, Grade E asphalt has been used, of 130-150 penetration,

Left—Motor Grader Striking-Off Base Stone. Right—Hand-Spotting Crew

OUTLINE OF SPECIFICATIONS FOR 1931 OF OREGON STATE HIGHWAY COMMISSION FOR BITUMINOUS MACADAM CONSTRUCTION USING HOT OIL OR ASPHALT

Width of roadway 18 ft.

Specification	B-1	B-2	B-3	B-5	B-6	B-7	B-10
Compacted thickness, in.	1⅜	2	2½	1⅝	2	2⅞	3
Gal. per cu. yd.	18.5	16.6	16.1	17.5	16.6	15.2	15.0
Tack Coat							
Asphalt binder, gal. per sq. yd.	.20	.20	.20	.20	.20	.20	.20
First Lift							
2½-1½-in. rock, cu. yd. per sq. yd.	....	....	....	....	....	....	.080
2¼-1¼-in. " " " " " "	....	....	....	....	....	....	....
2-1½-in. " " " " " "	....	....	....	....	....	.05	....
2-1-in. " " " " " "	....	....	....	....	.045	....	....
1½-1 or 1½-¾-in. rock, cu. yd. per sq. yd	.021	.021	.021	.030	....	....	....
Asphalt binder, gal.	.35	.30	.30	.45	.65	.65	1.05
Second Lift							
2½-1½-in. rock, cu. yd. per sq. yd.	....	....	....	....	....	....	....
1½-1-in. " " " " " "	....	.021	.021	....	....	.025	....
1¼-¾-in. " " " " " "	....	....	....	....	....	....	....
2¼-1¼-in. " " " " " "	....	....	....	....	....	....	....
Asphalt binder, gal.	....	.30	.30	....	....	.35	....
Third Lift							
1½-1-in. rock, cu. yd. per sq. yd.	....	....	.021	....	....	....	....
1¼-¾-in. " " " " " "	....	....	....	....	....	....	....
Asphalt binder, gal.	....	....	.30	....	....	....	....
Key Stone							
1-½-in. rock, cu. yd. per sq. yd.	.015 or	.015 or	.015 or	.015 or	.015	.015 or	.015
¾-½-in. " " " " " "	.012	.012	.012	.012	....	.012	....
Asphalt binder, gal.	.25 to .20	.25 to .20	.25 to .20	.25 to .20	.25	.25 to .20	.25 ....
First Seal							
½-⅜-in. rock, cu. yd. per sq. yd.	.008	.008	.008	.008	.008	.008	.008
Asphalt binder, gal.	.20	.20	.20	.20	.20	.20	.20
Second Seal							
½-⅜-in. rock, cu. yd. per sq. yd.	.008	.008	.008	.008	.008	.008	.008
Sand " " " " " "	.002	.002	.002	.002	.002	.002	.002
Summary of Quantities							
Asphalt binder, gal. per sq. yd.	1.00	1.25	1.55	1.10	1.30	1.65	1.70
" " " " mile	10,560	13,200	16,368	11,616	13,728	17,424	17,952
No. 3 road oil, tons " "	44	55	68	49	....	....	....
Grade E asphalt (130-150) tons per mile	....	....	....	....	50	66	68
Grade E asphalt (210-250) " " "	....	....	....	....	9	9	9
Total tons per mile	44	55	68	49	59	75	77
2½-1½-in. rock, cu. yd. per sq. yd.	....	....	....	....	....	....	.080
" " " " " " mile	....	....	....	....	....	....	845
2¼-1¼-in. " " " " " " sq. yd.	....	....	....	....	....	....	....
" " " " " " mile	....	....	....	....	....	....	....
2-1½-in. " " " " " " sq. yd.	....	....	....	....	....	.050	....
" " " " " " mile	....	....	....	....	....	528	....
2-1-in. " " " " " " sq. yd.	....	....	....	....	.045	....	....
" " " " " " mile	....	....	....	....	475	....	....
1½-1-in. " " " " " " sq. yd.	.021	.042	.063	.030	....	.025	....
" " " " " " mile	222	444	665	317	....	264	....
1-¾-in. " " " " " " sq. yd.	....	....	....	....	....	....	....
" " " " " " mile	....	....	....	....	....	....	....
1-½-in. " " " " " " sq. yd.	.015	.015	.015	.015	.015	.015	.015
" " " " " " mile	158	158	158	158	158	158	158
¾-½-in. " " " " " " sq. yd.	.012	.012	.012	.012	....	.012	....
" " " " " " mile	127	127	127	127	....	127	....
½-⅜-in. " " " " " " sq. yd.	.016	.016	.016	.016	.016	.016	.016
" " " " " " mile	169	169	169	169	169	169	169
Sand " " " " sq. yd.	.002	.002	.002	.002	.002	.002	.002
" " " " " " mile	21	21	21	21	21	21	21
Total aggregate " " " sq. yd.	.054	.075	.096	.063	.078	.108	.113
" " " " " " mile	570	792	1,014	665	824	1,140	1,193
" " " " " " sq. yd.	.051	.072	.093	.060	....	.105	....
" " " " " " mile	539	761	982	634	....	1,109	....

The quantities of asphalt binder shown in the tabulation above are for "hot" binder. Since the binder is shipped cold and expands considerably upon being heated, it is assumed that the expansion will be sufficient to take care of any waste that may occur. The quantities shown above should therefore be used when estimating or ordering material.

The rock quantities are "net" and 5 per cent should be added to take care of waste when estimating quantities to be stockpiled.

Asphalt Binder: B-1, B-2, B-3 and B-5 use No. 3 oil or 95 per cent asphaltic oil, B-6, B-7 and B-10 use 130-150 penetration Grade E asphalt except last seal. Use 210-250 penetration Grade E asphalt on last seal.

Left—Spreading Oil on Key Rock, 2-In. Bituminous Macadam Construction. Right—Applying Screenings on First Seal Coat

except for the final seal coat, for which 210-250 penetration is specified. To assist in the penetration of the asphalt and to obtain a more even coating of the stone and a thinner film of the asphalt binder, a water-soap solution equal to from 10 to 15 per cent by volume of the asphalt applied, is forced under pressure into the spray nozzles along with the asphalt. This forms a temporary emulsion which breaks quite rapidly and permits immediate rolling.

The sizes and quantities of rock in each course, and the quantities of asphalt used in each spread are shown in the accompanying tables. Some of these specifications have been written to use the sizes of rock available, as well as to vary the thickness of the finished work.

The Oregon State Highway Commission has adopted the policy of contracting this work when possible.

Special Features of the Multiple-Lift Type of Construction.—The multiple-lift type of construction differs primarily from the older types of bituminous macadam construction in that full use of machines in spreading the stone is obtained. The old method of casting the stone from stockpiles placed alongside the work was quite expensive, both because of the charge for the hand labor and on account of the wastage of materials.

The multiple-lift type of construction is much smoother than ordinary bituminous macadam work. The roughometer readings indicate that the roughness seldom exceeds 10 to 15 in. per mile and many times is as low as from 2 to 5 in. per mile. Smoothness is a very important factor especially with the high speeds of modern traffic.

The stone is also much better coated with asphaltic cement due to the layer or lift method of construction. This condition is further improved by the use of the water-soap solution as explained in the detail pertaining to the construction of the wearing course.

The costs of the multiple-lift type of bituminous macadam construction including the cost of an 8-in. macadam base are given below:

Spec.	Thickness of Wearing Surface Compacted In.	Thickness of Base Compacted In.	Cost per Sq. Yd. Wearing Surface	Cost per Sq. Yd. Cost of Base	Cost per Sq. Yd. Total
B-1	1⅜	8	$0.31	$0.68	$0.99
B-2	2	8	0.40	0.68	1.08
B-3	2½	8	0.54	0.68	1.22
B-5	1⅝	8	0.33	0.68	1.01
B-6	2⅛	8	0.41	0.68	1.09
B-7	2⅞	8	0.56	0.68	1.24

The costs can be reduced from 10 to 15 ct. per sq. yd. by using a 4-in. run-of-bank gravel or talus base and a 4-in. waterbound macadam top.

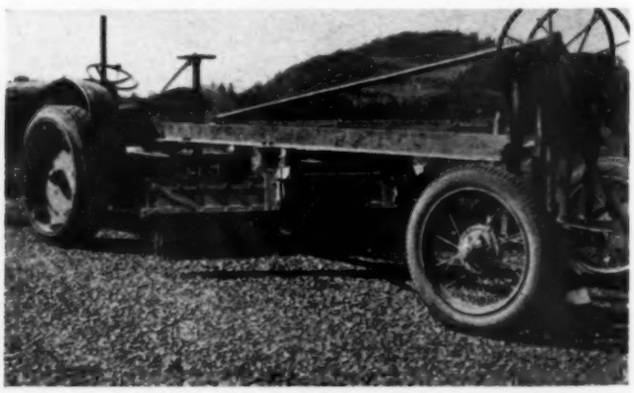
California Contractors' Bids Below Estimates.—The recently issued biennial report of the California Division of Highways for the period ended Nov. 1, 1930, contains the following analysis of contracts let during the biennium:

Number of contracts analyzed..... 234
Aggregate of low bids..... $27,582,557
Aggregate of engineer's estimates..... $33,164,245
Low bids are indicated as averaging below engineer's estimates 16.8%

About 80 per cent of bids were 10 per cent or more below estimates.

About 45 per cent of bids were 20 per cent or more below estimates.

About 4 per cent of bids were 36 per cent to 50 per cent below estimates.

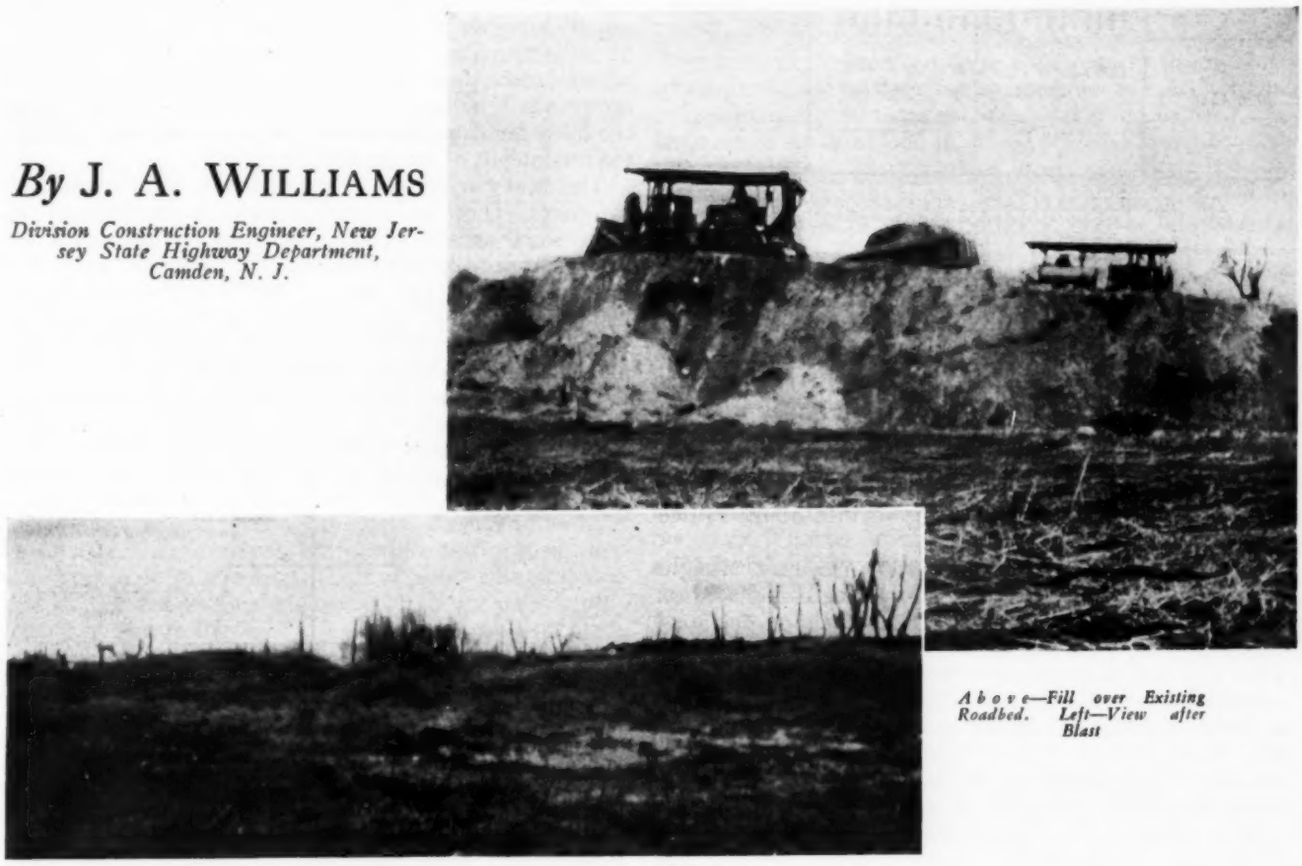


Left—Broom on Roller Used on Key Rock and Screenings. Right—Broom for Key Rock Course

FILL SETTLEMENT

By J. A. WILLIAMS

Division Construction Engineer, New Jersey State Highway Department, Camden, N. J.



Above—Fill over Existing Roadbed. Left—View after Blast

with the Use of Explosives

How road fills in New Jersey were settled successfully through mud to hard bottom by means of dynamite

THE coastal plain of south New Jersey abounds in tidal marshes composed of semi-plastic mud averaging 30 ft. in depth. The higher lands in this area contain a large percentage of sand and make an excellent fill material. Early roads were of floating fills and, because of continuous settlement, road surfaces did not last. It was essential to obtain solid fill material through the mud to the hard bottom. Dynamite has been used to bring about this condition in a minimum period of time. The dynamite has two functions:

1. To push out mud from underneath the fill.
2. To raise and loosen the fill, offsetting any bridging effect and adding to the compaction of the fill.

The immediate settling of a fill eliminates temporary pavements and their high maintenance cost. Permanent pavements are placed on new fills at once.

There is, of course, anywhere from a month to a year between the time the grading is done and the time the paving is put on, but that period is more or less a function of the legal handling of a contract, rather than a waiting to give frost action or any other natural action a chance to take place.

Building New Road on New Alignment

The first condition which we will take up is the building of a new road on a new alignment, the roadway to be not over 50 ft. wide at grade. It is a question whether or not that width should be spoken of. The width is more or less to meet the condition of the first roads that we built. They happen to be 50 ft. wide and we worked out the method to fill those particular roads but the later roads we have been building are considerably wider.

Disintegrating Meadow Mat.—The initial blasting removes or entirely disintegrates the mud or turf. From 50 to 10 ft. of roadway are shot in one blast by the propagation method, using 50 per cent straight nitroglycerin dynamite. (See Fig. 1.) The breaking of this turf is to stop the bridging effect and to let the fill material penetrate as far as possible into the surface of the meadow. We do not attempt to throw out the mat but merely break it up. One of the reasons for having this meadow penetrated by the dead weight of

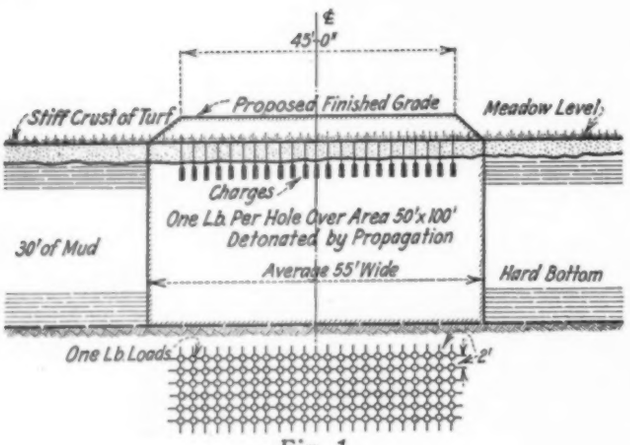


Fig. 1

the fill is that the trucks and equipment that are bringing dirt do not have to climb as high.

If it is wished to liquefy the surface or break it down, a great deal is saved on hauling and rehandling. Of course the left-over incline that is on the already settled work after a given section is dynamited, is pushed forward and used for leveling up the surface of the settled fill.

After the mat is disintegrated 60 per cent straight gelatin dynamite in cases with caps attached is placed on a three-point loading system. The depth of the mud determines the load, which is usually 50 lb. at each point. (See Fig. 2.) The dynamite in cases is placed in a triangular shape ahead of the fill. When the mat is thoroughly disintegrated the dynamite cases settle evenly with the fill. When the mat is not broken up, the dynamite cases are very often pulled out of line, so that the loads become misplaced and give an unsatisfactory result. It will be noted in Fig. 3 that there is a heavy iron wire—8 to 10-gauge—which is tied to each case of dynamite. The blasting-cap wires are wound loosely around this heavy wire.

Determining Fill Required.—When we are planning a road we calculate the amount of dirt needed on the basis of the hard bottom as determined by soundings.

The contractor sometimes does not quite believe the depths that we show, so consequently in our contract we put in a statement to the effect that the contractor must make soundings every 50 ft. ahead of the placing of the fill and on the basis of these soundings the depth of the fill to be placed should be determined. If his soundings show that there is 30 ft. of mud below the grade of the

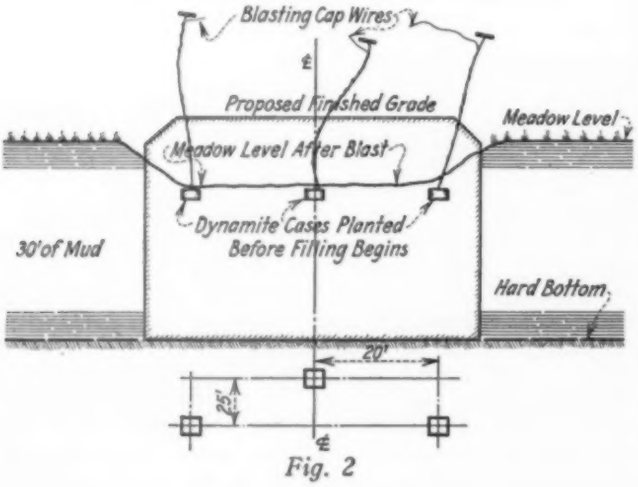


Fig. 2

meadow and our estimate shows that the surface of the road should be 10 ft. above the mud, that would make a total of 40 ft. of fill. Allowing 10 per cent for compaction we will then make our heavy iron wires 44 ft. long from the case to the end.

The wires are wrapped on a board and these boards are usually hung on sticks that are stuck in the surface of the fill so as to make them visible. It is the job of one dump man to watch them and see that they are not destroyed by the trucks running over them. As the fill settles and as the fill is built up, the boards are unwound until we have the total depth of fill required in place.

The heavy wires act as a protection for the blasting-cap wires. There has been practically no breakage of cap wires since we started this system. Previous to the use of this iron wire we used double telephone wire, tied around the cases and then connected to the blasting cap primed in the case. The twisted telephone wires were not strong and were made of copper wire and seemed to be more inclined to become short-circuited.

How Soundings Are Made.—We make soundings with an ordinary piece of ¾-in. pipe and find it satisfactory and accurate up to a depth of 40 ft. Our meadows contain a certain amount of roots and logs and we have

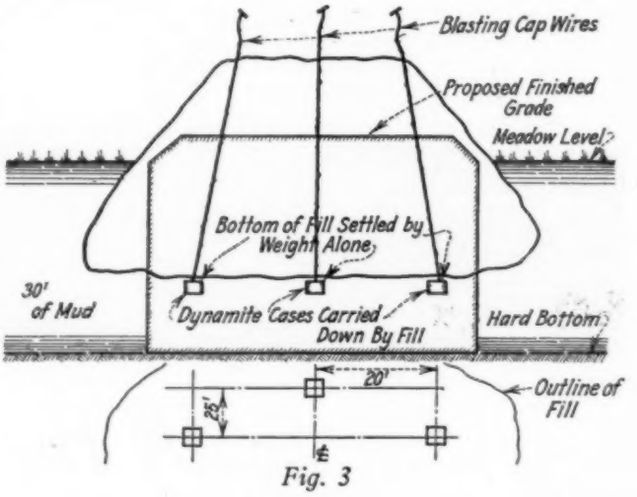


Fig. 3

found an auger very unsatisfactory. At some place in most of these meadows there is a bridge. Our pipe surveys are made first; after that soundings are made for the bridges. These soundings will be taken with a pile driver or well-drilling equipment and are usually put down 30 or 40 ft. below what we expect our bridge foundation to be, exploring for pockets that are liable to give way and wreck the bridge structure. We have these bridge soundings checked against our pipe soundings and we always have the contractor make soundings immediately ahead of placing the fill. After a blast takes place, the contractor is again required to make soundings.

Placing the Dynamite.—From Fig. 3 it will be noticed that the loading is triangular in shape and that it is about 25 ft. ahead of the toe of the previously settled fill and it is covered over by 25 ft. of new fill placed ahead of it. This keeps the fill at all times with a point ahead, which tends to split the mud and force it to either side. The front width of this fill is about 10 ft., which is the dumping width of a truck and the pointed shape of the fill is maintained by the bulldozers pushing material out after each explosion. As a section of the fill goes down, a pile of mud is pushed up ahead. Sometimes that mud pile will resettle in the time that it takes us to put in the 25 ft. of dirt between the previously settled fill and the point where we are go-

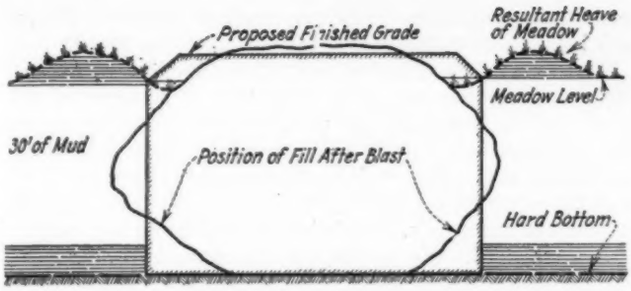


Fig. 4

ing to put our dynamite cases. If the mud pile has not gone down by that time, we put in a small charge of dynamite and blow the pile away.

The dynamite cases on the bottom of the fill settle from 6 to 10 ft. by the weight of the fill. When the shot is fired the remainder of the mud is pushed out and the fill is dropped to hard bottom. (See Fig. 4.)

We have tried placing the dynamite deeper than is shown in Fig. 3 and, while it does some good, it does not give as much final settlement as when the dynamite is placed close to the bottom of the fill.

Soundings are made along the toe of the fill, and where the fill is not down, dynamite charges up to 50 lb. are loaded through 6-in. casings. This system of loading will be described later. This additional blasting causes settlement as shown in Fig. 5. In this operation we first place an overload on the top of the fill. This overload quite frequently is the dirt that we have left over from the incline used to make the runway up the fill before it has settled. We drive a casing down through the side and place anywhere from 35 to 50 lb. of 60 per cent straight gelatin dynamite in the mud under the toe of the slope. The dynamite we are using comes in 5x16-in. cartridges. There are three of these in a 50-lb. case. When the explosion takes place, the caving-down is practically the same action as we have when the first explosion takes place.

When we first built these roads we worked under the theory that if we had the bottom of the fill down to hard ground for the same width as the top of the road, the fill would stand. This worked very nicely for the first two years that our fills were in place. In the third year we would notice a settlement at the sides and in some fills a decided increase in the crown of the road. Investigation showed that this settlement was due to a chemical action in the mud, as well as a mechanical action. The meadow material is unstable chemically and the change in pressure seemed to increase this action. Accordingly we feel that it is essential to have a greater width of our fills on hard bottom than we did several years ago and that is the reason for our placing the loads of dynamite as shown in Fig. 5.

Building New Road on New Alignment Where Roadway Is Considerably Over 50 Ft. Wide

The procedure is similar to the first condition. The meadow mat is disintegrated and the fill is carried to hard bottom by the three-point loading system for 50 ft. of its width on the center-line. Each side is then loaded by the three-point system. The loads are increased usually 100 lb. at each point and the fill is piled up by the end-dumping system. Both sides are shot at once, usually in 50-ft. sections. This method is the outgrowth or the enlargement of our method for building roads 50 ft. wide.

When we put down the center section the mud can go in both directions. In so doing, it compacts itself on each side of this center section. When the side sections are to be settled, the mud already compacted is harder to move and can only go further out to one side; hence the need of doubling the amount of dynamite used. After this explosion we re-sound and quite frequently we find that it is not necessary to do this over side drilling. However, we believe in taking all necessary precautions to insure the toe of the slope being down to hard bottom.

On extremely wide roads, judgment must be used. In some cases, loads of 150 lb. of 60 per cent straight gelatin dynamite on 30-ft. centers have been used. I have thought that the next time I have a road to build that is over 50 ft. wide, instead of trying to put the fill down in three sections I am going to endeavor to use a modification of the three-point method by possibly using five charges in a wedge instead of three and endeavoring to put down the fill at one time. Of course, because of the additional covering, I can use heavier charges than 50 lb. and I am in hopes that it will work out. I may even go to a seven-point load.

I have been asked how close to another fill a blast of this nature can be made without damaging the other fill. The answer is that it depends on the amount of dynamite set off. We had a case of a railroad grade 400 ft. from the shot. We were using a line of double charges, having a total of 1,100 lb. The railroad fill was thought to have reached hard bottom. Later soundings proved this was not the case and we moved the railroad fill about ½ ft. out of line.

We have had considerable experience settling fills close to bridges. In one case we stopped 150 ft. away from the bridge abutments. Later, material was filled in and as natural settlement took place, due to the weight of the fill, this new fill acted as a wedge and forced the bridge plate girder through 3 ft. of concrete. When we come to a stream now, we just forget that the stream is there and fill right across it or we fill across and settle with dynamite so that we get the toe of our slope several feet beyond to top of where it will be when the bridge is finished. Then we re-excavate where our bridge abutments will be.

Rebuilding Road on Same Alignment over Existing Road, Maintaining Traffic

First we disintegrate and settle the existing floating roadway fill with charges of dynamite placed along the toe of the slope. Three or four feet of new fill is piled in the center of the roadway before the blast. Most of

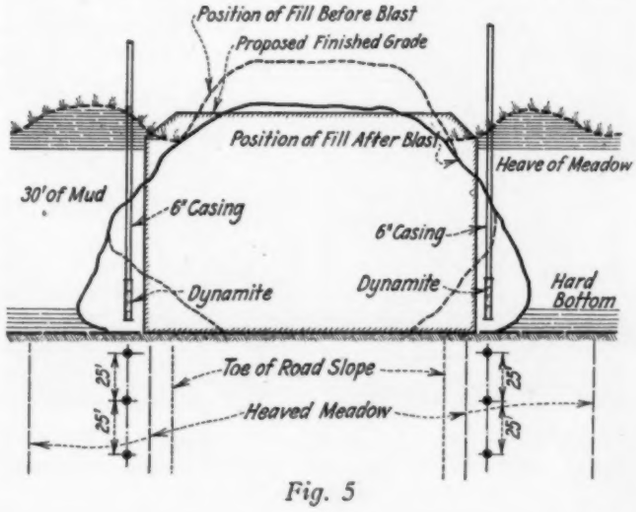


Fig. 5

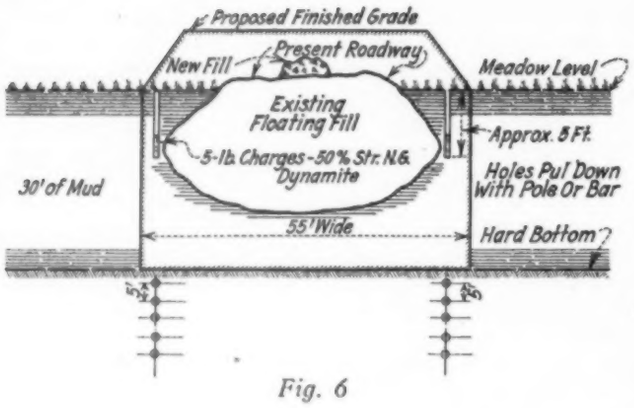


Fig. 6

these old roadways have become a part of the meadow level and it is essential to break the bridging effect between the meadow mat and the existing floating fill in order that this fill may more readily settle when new material is put on top.

We found by experience that when the blasts at the toe of the slope were set off, a crack appeared in the center of the road. Unless this crack was immediately filled with new material, mud came up from the bottom and caused us serious trouble. Hence, this 3 or 4-ft. depth of fill material is piled in the center of the road, leaving sufficient room on each side for traffic to pass.

The blasting of the toe of the slope is simply shooting two ditches, usually 300 or 400 ft. at a time, on either side of the road. We find the best results obtained when both sides are shot simultaneously. Immediately after the blast a bulldozer spreads the piled-up fill so that traffic can move readily. Fig. 6 shows the existing floating fill and the position of the charges on each side.

The depth and amount of these charges are determined by the position of the toe of the slope. The fill is then built up by the end-dumping method until the total requirement is in place. Usually 100 ft. of roadway is built up at a time.

Three lines of holes are put down, as shown in Fig. 7, by means of a portable pile driver. The holes are on 50-ft. centers in each line. It has been found advisable to use a 6-in. casing and 5x16-in. 60 per cent straight gelatin dynamite. Usually 100 lb. of dynamite is placed in each hole and 100 ft. of roadway shot at a time.

Since traffic must be maintained while this is going on, it is necessary to have two runways, one at each end, in order to maintain the road for passing vehicles. After each blast these runways are used to level-up the fill.

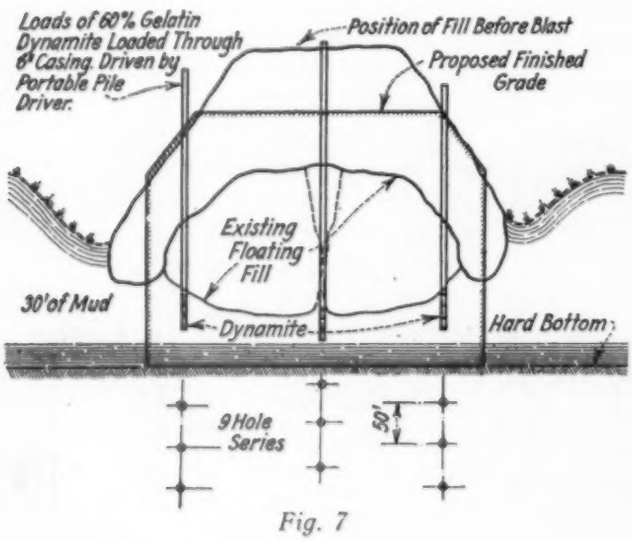


Fig. 7

There may be a question regarding the amount of explosives which we use. We find that it is essential to break up the bridging effect which the old fill has and this requires considerably more dynamite than if we had a solid new fill. After each blast, soundings must be taken in order to insure complete settlement. This point cannot be stressed too much. If the fill is not down the operation is repeated. We determine the amount of fill to be put on in the same manner as previously described in building a new road on new alignment, even though we do not put in case lots of dynamite and we use a board in place of the case of dynamite. The wire again equals the depth of the required fill.

In some instances it has been necessary to put in charges of dynamite and break up the old roadway for a complete cross-section, in order to avoid a bridging effect.

Semi-Floating Fill with Pavement Settled Out of Line and Opened Up

This is a condition which is usual all over the country. A road has held up under traffic for years with some sort of semi-permanent pavement which requires periodic maintenance. This semi-floating fill has been settling without giving any indication of it because the settlement has been made up by this periodic maintenance. A resurfacing contract is let to put a hard-surfaced pavement on, and 6 months after completion a settlement is noticed in some location where there had been no warning of bad foundation conditions. This condition, after it has been righted once or twice, is likely to convert one over to the idea of sub-surface surveys, or soundings in any suspicious looking piece of road that may be under consideration for resurfacing.

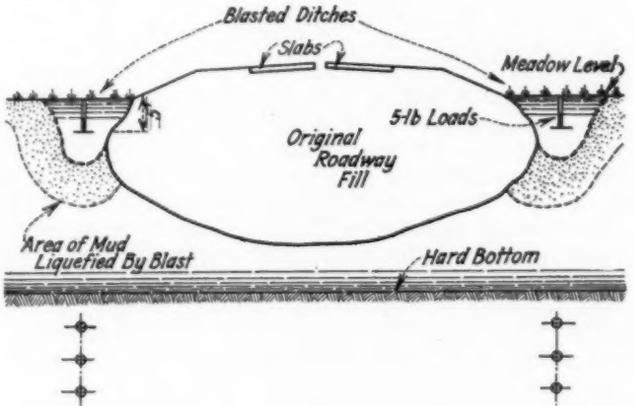


Fig. 8

Condition of Old Road.—In the case of this particular road, the old road had a 30-ft. graded width with an oil-treated gravel surface and it was a matter of record that this road had been used for nearly 100 years with no thought of foundation trouble. The concrete opened up in the center and the sides settled. The problem was to reinforce and widen the fill and bring the pavement to line and grade. In order to do this without spoiling the pavement, it was necessary to dump material over both sides and force as much as possible of this under the settled road and at the same time get the fill in a stable condition and do as little damage as possible to the hard surface.

Blasting and Filling Operations.—We blasted a ditch

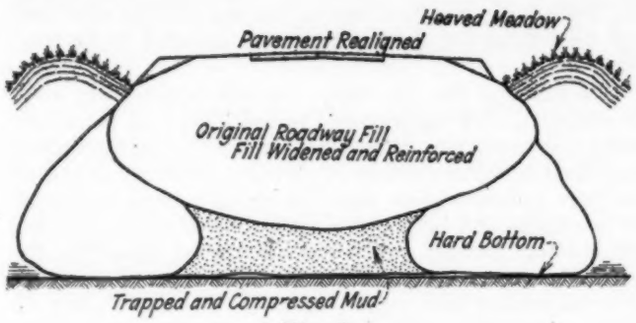
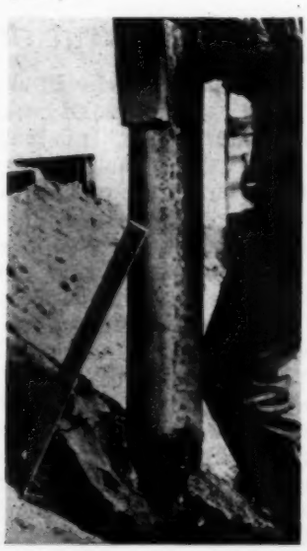


Fig. 9

on each side of the road, as shown in Fig. 8. It was not essential to throw out a great quantity of material but it was very essential to liquefy the mud to as near hard bottom as possible. In many instances it was necessary to go in with light charges after the ditch was blasted and use these charges to stir up and mix the mud and water.

We next end-dumped into the ditch and pushed the material down with the bulldozer. (See Fig. 10.) It was essential to keep the mud liquefied ahead of the solid fill material and it is surprising the amount of fill material which can be pushed under the orginal roadway fill. We kept our charges of dynamite light at all times because we wanted to stir with them and not blow mud out. This reinforcing operation was usually 20 ft. wide at the meadow level to allow both truck and bulldozer on the fill. As the bulldozer pushed the new fill down, the muck would have a tendency to pile up in front. When this took place we used a charge of dynamite to blow this muck away. When one side was complete we handled the other side in a similar manner. The mud in the center was trapped and compressed sufficiently so that the original roadway did not have any further material settlement. (See Fig. 9.) When the fill is complete, as shown in the desired cross-section, it is still necessary to bring the old pavement to line and grade.



Left—Portable Pile Driver for Driving Pipe: 800-Lb. Hammer, 14-Ft. Leads; Capacity, 30-Ft. Pipe. Right—Placing the 6-In Mandrel

Operation 1 for Bringing Old Pavement to Line and Grade.—Establish alignment and grade of the center-line of the pavement with a string. Mark each corner of each individual slab for grade and alignment so that anyone can see how far up each corner can be raised and how far over toward the center each slab must be moved. The amount of fill necessary to be placed under each slab in order to bring it to grade is figured and the required amount of sand is piled on each slab. We use sand because it is a uniform granular material, and there is a minimum subsidence. Besides, it is generally more easy to handle than any other material.

Operation 2.—Four or five slabs on one side of the road are moved at a time because the slabs are doweled together at the ends and we do not want to break the ends apart. Three 5-ton jacks per slab are used under the outer edge. The outer edge is jacked up a sufficient height so that center blocks, usually three to a slab, can be placed and the jacks lowered until the slabs are balanced on these center blocks. The blocks are so placed that when the slab is balanced it will be at the proper

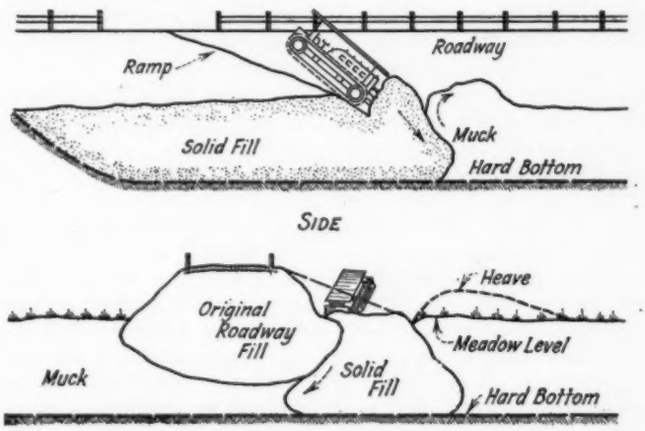
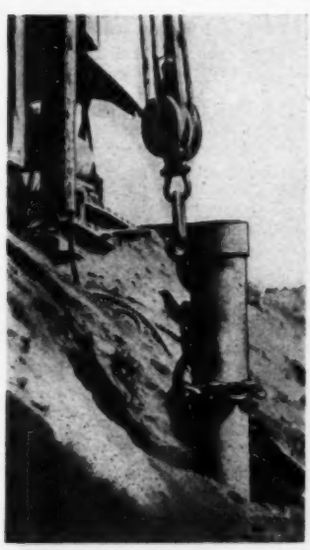


Fig. 10

grade. While this is being done the traffic is temporarily forced to the adjacent side, one-way traffic being maintained. No attempt is made at this time to bring the slabs to center-line but only to get them to grade. The sand which is piled on each slab is forced underneath that slab by means of poles and pushers. When all the sand is underneath the slab we know that the slab will come



Left—Withdrawing the Mandrel. Right—Tamping Dynamite with Wooden Tamping Stick. Note Large Cartridges

to the required grade. This is continued progressively until all the slabs on one side are brought to grade. Then the other side is handled in a similar manner.

Large hooks, couples and turnbuckles are attached to several slabs and the side to be moved into line is jacked up. The traffic travels on the opposite side of the road. The turnbuckles are usually over the slab that we are moving. That slab is jacked up to reduce the surface friction somewhat, the slab being supported on one edge on the jacks. When the turnbuckles are tightened, this slab will move and the other one stay in place. In this manner all the slabs on one side are moved into line, the jacks removed and the opposite side jacked up and brought into line.

Equipment for Putting Down Loading Holes

Many different methods have been used to make holes for loading dynamite. I believe we have tried every method we have heard of. The portable pile driver, using first mandrel and then an open pipe for loading dynamite, has proved very efficient and economical for us. We use a small pile driver with 14-ft. leads and an 800-lb. hammer. This outfit is operated by a single-drum hoisting engine having a niggerhead on the drum. The whole outfit is mounted on the frame of an ordinary 3½-ton truck, the regular body having been removed. The mandrel is regular 6-in. casing with a point attached to it.

The operation is to drive this mandrel down the required depth and then pull it out. This gives a hole down which the open pipe can be very readily pushed. The mandrel is, of course, driven with the hammer and it is pulled with a 5-way block and rope attached to the niggerhead. We have heard and we know that it is sometimes a great deal more difficult to pull out a pipe than it is to put it down, but because of the vibration of the engine on the truck and the fact that the springs of the truck put a constant tension on the pulling rope, we find no difficulty in pulling out either mandrel or loading pipe.

Site of a Proposed Highway before Construction, 1927

Same Site in 1928, Grading Completed

Paving Completed in 1929

The mandrel can be driven through almost any kind of material. We have gone through logs and pieces of stumps without any difficulty. The end of one mandrel was made with an old 6-in. projectile. After the mandrel has been pulled a 12-in. square piece of roofing tin is cut on the edges and bent and placed on the bottom or open end of the loading pipe. The open pipe with this tin on the bottom is then pushed down the required distance. It is surprising how much resistance this small piece of tin has. In many cases where only fill material is to be encountered, the mandrel is not used and the loading pipe driven down with only the tin over the bottom. The dynamite is then loaded through the 6-in. casing, using cartridges 16 in. long and 5 in. diameter. These cartridges slide readily to the bottom of the pipe. After the primer cartridge is in place the dynamite is held down with a wooden tamp pole while the pipe is pulled. The tin naturally stays at the bottom of the hole. Water is used as tamping, and also assists in the ease with which the pipe is removed.

The great success of this operation is due to speed. Neither the mandrel nor the loading pipe is allowed to stay in the ground sufficiently long so that material sets around it. As was said before, the leads on this outfit are only 14 ft. but we have had no trouble driving a pipe 30 ft. long. We do this by means of a chain attached to the hammer with the other end hooked into the top of the pipe to be driven. As the hammer is dropped the force of the blow is transmitted to the pipe through the chain. It is our belief that this type of equipment will place dynamite where it is wanted in a more economical manner than any other equipment we have so far been able to find.

Acknowledgement.—The foregoing is a paper presented Feb. 19 at an annual meeting of the Association of State Highway Officials of the North Atlantic States.

Truck Operation in Contracting

"Operating Trucks Profitably in Contracting" is the title of a well prepared booklet published by the General Motors Truck Co. It is really a report on the economics of truck operation in two types of business. The first part discusses the problem of hauling from the material dealer's point of view. The latter part is devoted, aside from some strictly equipment discussion, to a thorough analysis of the general contractor's hauling problems. Examples are given as to how to calculate truck supply. They are taken from actual construction work observation.

In every kind of construction work the primary tool of that class of work is the pacemaker. Every other operation, for economy of the whole, should be coordinated with the primary unit. As this report brings out, a truck is simply a transportation tool and as such should be kept up to a high standard of operating efficiency. Many points are discussed in this booklet, which will help the construction superintendent to keep his hauling units going at the maximum of efficiency. Many of the points discussed are vaguely generally known but this report puts the spotlight on those points through which drains on profits occur.

Planning and scheduling deliveries to prevent delays on the job is a fundamental factor in successful contracting. This report tells how this can be obtained.

EDITORIALS

Let Us Give Publicity to the Need of Public Works Expenditures

THE Wagner bill provided for a Federal Employment Stabilization Board composed of four cabinet officers whose function it would be so to time federal construction expenditures as to provide work on a large scale when private industry is slack. This bill met with quite general approval by newspaper editors, an approval that would have been somewhat less enthusiastic had the editors been more familiar with construction statistics.

The income of the American people has averaged about 100 billions annually. The total expenditures for construction, public and private, have never exceeded 10 per cent of the annual income, and of this total only about one-third is classed as public works. Hence public works expenditures normally constitute less than 4 per cent of the income of our people. During "hard times" this income declines about 15 per cent. Therefore public works would have to be increased about four-fold to take up the slack due to the depression. By dint of considerable effort public works expenditures in 1931 will be increased about 15 per cent over those in a normal year, which is a far cry from the 400 per cent increase that would be necessary to offset the general slump in business.

No further argument is necessary to make it evident that a complete cure for hard times is not to be found along the lines of the Wagner bill. That bill is praiseworthy in that it will serve to set a good example. It is, however, merely one move in the right direction, and the sooner that it is generally seen to be that and little more, the sooner will other steps be taken to reduce the violence of the swings in the business cycle.

We whose interests lie largely in the field of public works should join in every effort to increase expenditures for public works wherever such works are justifiable. Our highways are still very far from ideal. Our domestic water supplies are often miserable in quality and not always sufficient in quantity, as the recent drought has shown. Our sewage is, for the most part, still dumped untreated into rivers and lakes. Our public parks are as a rule inadequately provided with golf links, tennis courts and other recreational devices. For these and many other kinds of public works there is a vast potential demand that can be developed into actual demand, but unfortunately there is lack of adequate effort to develop it.

Advertising is not ordinarily used in creating a demand for public works, so the most economic means of developing demand lies almost unused in this field. We trust that we shall be pardoned if, for ourselves and other editors of periodicals that serve the public works fields, we claim that the magazines in these fields have been the most potent means of increasing the demand for public works. Our subscribers furnish us with data which we make public, relative to construction economics including construction needs. Facts and arguments thus published find their way into the annual reports of city, county and state engineers and commissions, and thence into the newspapers. Federal and state aid for highways, for example, started in a very small way, and for a long time the only persistent advocates of it in the publishing field were the editors of ROADS AND STREETS.

The universal metering of water long received, and still receives, no persisting support from any publications except those serving the waterworks field. The same holds true as to the chlorination of water. In this last named campaign the editors of periodicals in the civil engineering field have been united from the start, and have so effectively aided in the spread of knowledge about chlorine treatment of city water that typhoid fever is almost a thing of the past in American cities.

It will be seen that while we advocate increasing public works during "hard times," we are opposed to decreasing public works during "good times." On the contrary, we believe that public works expenditures have always lagged behind the economic needs of our people, largely because so little organized and persisting effort has ever been made to show the public the nature and extent of those needs. "Good roads clubs" form about the only examples of persisting effort to persuade the public to increase its expenditures for public works, aside from the efforts of periodicals that specialize in public works.

If we are to play our part in the campaign against future hard times, we shall be effective in proportion as we arouse the public to the need of greater annual expenditures for public works.

W. P. Gillette

Counties Failed, State To Try

RECENTLY the North Carolina legislature passed a bill transferring all authority for all road matters to the state highway department. It was signed by the governor and goes into effect July 1, 1931. This setup is a radical departure from general practices, and establishes a precedent. "All road matters" include those of state, county and township.

The bill was the outgrowth of an investigation made under the general direction of Governor O. Max Gardner. This cooperative survey of county road mileage and financial operations of the counties was undertaken by the state highway commission, the state tax commission and the Bureau of Public Roads of the U. S. Department of Agriculture. Their report included the following set of recommendations (italics are ours):

1. It is recommended that the present law giving counties the option of using their allocation of gasoline tax for general county debt service or for road purposes be amended so as to limit the use of such funds to road purposes. This law now requires that expenditures of the proceeds of the 1-cent gasoline tax for local road purposes be made under the supervision of the State highway commission. The gasoline tax is imposed upon motorists to provide for highway improvement and upkeep, and *a diversion of these funds to other purposes should not be made.*

2. Recent additions of county roads to the State highway system have created a condition whereby the State highway commission, with its present supply of funds, will not be able for many years to improve in accordance with traffic requirements the mileage now under its control. *Further additions to the present State highway system or diversions from the State highway fund to other purposes should not be made.*

3. This investigation reveals that under the present *county and township* organizations *road funds are, in many instances, expended without regard to the traffic importance of the particular roads improved.* To remedy this condition provision should be made for a classification of local roads on the basis of traffic surveys and other investigations by State and local officials working in cooperation, and for the development of a financial plan to provide for the progressive construction and annual maintenance of the several classes consistent with the resources avail-

able and the traffic importance of each class. Pending the development of such a plan, *there should be no increase of taxation for local road purposes.*

4. *Machinery purchases, operation, and upkeep for local roads are the occasion of much uneconomical expenditure.* Some adequate State supervision and control should be established so that necessary machinery purchases may receive the benefit of the reduction in price to be obtained by group purchasing, that the selection of machinery may be more in accord with the actual needs, and that large units of equipment needed for only occasional work may be moved from one point to another, to the end that waste by idleness of this class of equipment which now exists can be avoided.

5. It is apparent that *efficient utilization of the present county convict forces presents great difficulties,* especially in the ordinary maintenance of the roads, and it is likewise apparent that there are few counties that will have sufficient money available for construction purposes in the immediate future to give profitable employment throughout the year for their convict forces. It seems necessary, therefore, that in order to work county convicts economically they must be divided under two general groups, so that those who are classed as "honor prisoners"—those who can be worked without guards—can be utilized in ordinary maintenance work by the counties; and that those prisoners who have to be worked under guard, and therefore in larger groups, may be administered under some plan of district organization composed of several counties operated under the control of the State prison. Local road organizations could then obtain from this district camp groups of prisoners from time to time for use in the construction of roads, when funds are available for that purpose; and the district prison camp could develop such other lines of work as would supplement the road work that was available.

6. All township and special road district organizations should be abolished at an early date, and *all control over the roads* now under their supervision *should be vested in organizations of wider territorial jurisdiction.*

7. *Additional powers should be vested in the North Carolina County Government Advisory Commission over budget and accounting affairs in the counties.* At present these powers are advisory. The addition of supervisory and regulatory powers to this commission would be of great value in further standardizing financial procedure and safeguarding public expenditures.

8. Plans should be formulated whereby a State purchasing agency may serve the local road organizations in the standardization and purchase of road equipment and supplies.

9. Finally, *it is recommended that the State highway commission be charged with general supervision over improvement and maintenance of the roads classed as of major importance under the classification of local roads on the basis of traffic surveys,* as proposed in paragraph 3.

The bill as passed was not, however, wholly in accord with the recommendations. One departure, for instance, was the adding of an additional cent to the gas tax.

In viewing this circumstance from the county viewpoint, we should look upon this procedure as an interesting experiment; and an experiment it is, for it has no precedent. It is a challenge to county officials in every state to be certain that they develop their practices to a degree of maximum efficiency and in accord with sound economic and technical principles. One of the preliminary principles which cannot be stressed too much is that a definite plan of improvement should be adopted and followed.

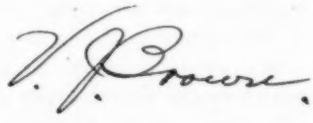
While the important principle of home rule as established in the counties is at stake in this instance, the more important factor in North Carolina was the desire and immediate necessity (accentuated because of the present depression) to relieve the tax on real estate for road purposes. The people of the various counties throughout the state asked the governor to have the law changed so that their property and road tax in the counties would be reduced. They desired to shift the tax burden so that their highways should be paid for by gasoline and motor vehicle taxes, rather than by property tax. This result has now been obtained; the tax has been removed from the land and placed on the motor vehicle.

Should Counties Be Merged For Highway Purposes?

WHAT should determine the size of a lateral or secondary road building administrative unit? It has been often said that many counties are too small a road building unit and that townships are too small a unit. The American Road Builders' Association has gone on record to this effect. Those who have studied the situation in the radical step taken by North Carolina when the legislature transferred jurisdiction over all road matters to the hands of the state highway department realize that the county unit was satisfactory, and still is in some instances, but that in many others counties are too small a unit. The reason given for this statement is that the transportation facilities are much improved from those when the boundaries of counties were first fixed and when the average day's travel was not more than 30 miles.

Should the size of secondary or lateral road administrative areas be determined by the present scope of travel of a day's driving by automobile, or, as part of a problem of the transportation system of the state as a whole, or should these be minor determinants? What kind of measuring stick can be used to determine the limits of a secondary road administrative district? The report to the governor in the North Carolina situation stated: " . . . at least half of the present number of counties could be consolidated . . . ."

What, besides experienced opinion, was responsible for this statement? The fault with most surveys of the sort to which reference was made, is that it fails to recognize the progress which has been made by progressive counties and to point to these as examples of what might be expected if unsatisfactory elements were generally removed from county administration and adequate finances made available.



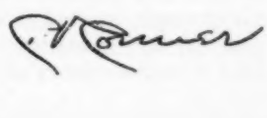
The Highway Missionary

THE development of many types of equipment, materials and methods used in highway work must be credited to a relatively small number of manufacturers in each field, and in several instances, to but one manufacturer in that specific field.

As illustrations, much of the worth-while research on culvert pipe has been done or financed by one company. Nearly all of the worth-while and impartial research on the value of reinforcement in concrete pavements was paid for by one company.

In each instance these companies were the pioneers who, visualizing a need and an opportunity, were willing to invest their own funds in needed researches which have since benefited not only themselves but their competitors.

This reaping without sowing is less common now than formerly because manufacturers are uniting as trade associations for the specific purpose of jointly paying for research, as well as the promotional activities which follow and are based on the results of that research.



County and Township Roads

A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement

Groveland Road, Similar to First Mile of Traffic-Bound Gravel Built at Lincoln. Ditches Not as Deep or Wide as Desirable, but Surface Excellent

Method of constructing traffic-bound gravel roads in Logan County, Ill.—Taxpayers pleased with results—Entire county road system to be graveled

By EDW. J. TOBIN

Superintendent of Highways, Logan County, Lincoln, Ill.

ABOUT ten years ago Logan County, Ill., voted a $500,000 special tax over a 5-year period and constructed some 50 miles of gravel roads. Material was secured from two local pits and was put on the roads just as it came from the pit, varying from 60 to 80 per cent sand. Experience not only proved that the taxpayers did not secure enough benefit to warrant this expenditure but also that the highways thus improved were not at all suitable for present-day traffic.

Late in the fall of 1929, after two years of new construction with coarse washed gravel, the county board, under my direction as county superintendent of highways, constructed a mile of traffic-bound gravel road at the city limits of Lincoln, the county seat. This road was built on a stretch of soft and gummy black dirt where drainage was very poor. One-half-inch washed gravel was placed 12 ft. wide and 6 in. thick and then bladed to the sides, as explained later, and traffic was turned on to the road.

Before completing spreading of the gravel a heavy freeze occurred, and all during the next three months the road was subjected to heavy snows, rains, freezes and thaws. While there was some cutting through the gravel by heavy traffic, still the road was always in good condition for winter travel. However, this exceptionally wet weather allowed the gravel to become rapidly impacted into the dirt and early spring found the roadbed in perfect condition.

Not only the farmers who used the road daily, but people from all over the county were so well pleased with the excellent roadbed made by the small-size washed gravel that the county board was urged to and did construct during the 1930 season four other pieces of road varying from 3 to 7 miles in length, scattered over the county so that everyone might have a chance to observe the methods of construction and the results obtained.

Equipment.—Before starting the 1930 work, the county bought a large crawler-type tractor and a heavy 12-ft. grader with backsloper attachment for making ditches. Practically all the work of grading the 17 miles

Curves Were Rounded to a Radius of 300 Ft., so that Traffic Will Move Rapidly and Safely

of roads was completed with this outfit assisted by one smaller tractor and a 10-ft. grader. A 60-ft. roadway was provided and additional right-of-way was purchased at all corners in order to make large curves.

Grading Operations.—The roadbed was graded for a 30-ft. surface with ditches 8 or 10 ft. wide on either side. While the ditches were perhaps deeper than necessary, it was felt that they could fill up with considerable loose earth and, with their ample width, still take care of all necessary drainage for many years. This was considered most important; for, once the gravel surface was completed, it would be expensive and impracticable to go into the ditches for deepening and cleaning, as there would be no place to put the earth except on top of the gravel.

Graded Road with Wide, Deep Ditches with Sloping Banks. Surface Has Just Enough Crown to Furnish Good Drainage after Gravel Is Applied to Center 20 Ft. of 30-Ft. Roadbed

The roadbed proper was left with a crown of about 3 in. across the 30-ft. surface and this was dragged and rolled down as solid as possible before applying gravel. The average cost per mile for all the grading was $400. Precast concrete culverts with headwalls were installed at all farm entrances and laterally across the roadway wherever needed at an average cost of $500 per mile.

The Gravel.—The county purchased the gravel from pits at Pekin and at Chillicothe, Ill., specifying ½-in. washed gravel, meeting grade No. 3 of the Illinois state highway specification No. 4 for gravel highways. The gradation of this gravel is as follows: 100 per cent passing ½-in. sieve, 70 to 90 per cent passing ⅜-in. sieve, not over 25 per cent passing a ¼-in. sieve and not more than 10 per cent passing through a ⅛-in. sieve.

Spreading the Gravel.—A contract was let to a trucking firm for unloading, hauling and spreading the gravel. This contractor used a belt conveyor under the track to unload from hopper-bottom cars into large dump trucks which dumped the gravel into an automatic spreader pulled by a tractor. The gravel was spread 9 ft. wide and 8 in. thick, using 1,172 cu. yds. to the mile. This, with the several yards dumped at the intersection of all cross-roads, brought the quantity used to about 1,200 cu. yd.

Outfit Spreading Gravel. Tractor Is Hitched to Spreader so that Trucks Can Back around Tractor and Dump into Hopper. As Tractor Moves Forward, Spreader Deposits Gravel 9 Ft. Wide and 8 In. Thick. Adjustable Bar on Spreader Varies Thickness to Allow for Crown or Unevenness of Grade

The average cost of the gravel, including freight and trucking, was about $2.63 per cu. yd., or approximately $3,100 per mile of road.

As soon as the contractor completed laying gravel on one mile a motorized grader was used to push most of

Motor Patrol Blading Gravel into Windrows. Two Round Trips Necessary to Push Desired Amount of Gravel off Center into Windrows, Leaving a Layer About 1 In. Thick

Roadbed with Gravel in Windrows at Side. In Some Localities where Snowfall Is Heavy, Gravel May Be Pushed All to One Side to Avoid Filling Roadway with Snow and to Allow Clearing to One Side. As Gravel Is Compacted by Traffic, Additional Thin Layers Are Bladed In

the gravel into windrows on either side of the road. Loose gravel was left on the roadway to a depth of about 1 in. and the windrows of gravel were placed so that about 16 ft. was available for traffic between them. This allowed several feet of the roadbed on the outer side of the windrows so that the gravel would not be wasted into the ditch. It is the plan that a grass sod will grow on these strips as well as on the sides of the ditches which were kept in a very gradual slope to eliminate caving or washing.

Dragging.—As the traffic compacts the gravel a long multiple road drag pulled by a small tractor keeps the surface smooth by dragging about once a week. However, the amount of dragging is governed a great deal by the volume of traffic and the weather. When most of the loose gravel is packed into the dirt, another 1-in. layer of gravel is pulled in from the windrows and spread evenly over the surface of the roadway. This is continued until the entire amount of gravel is compacted into a roadway aproximately 20 ft. wide.

The use of small-size gravel precludes the possibility of any great quantity of dirt accumulating between the pebbles of gravel, so that there is little chance for softening up of the roadbed once it is firmly packed. After this type of road is completed, the surface is smooth and practically waterproof. The 20-ft. gravel surface allows traffic to move about so that no regular lanes are followed and no ruts developed.

In the near future the county highway officials contemplate a county bond issue to be paid out of the motor-fuel tax funds for the purpose of graveling the entire county road system under the traffic-bound method with ½-in. state specification gravel.

North Carolina Has Complete Atlas of County Highways

The first complete atlas showing county roads in North Carolina has just been completed by the state highway commission and the U. S. Bureau of Public Roads. The maps were compiled after a survey of county roads and the financial operations of local road authorities in which the state highway and tax commissions and the bureau cooperated at the request of Governor O. Max Gardner. They are made on a scale of 1 in. per mile, and are perhaps the first complete county road maps for any state in the country. There are in all 100 maps, one for each county.

The maps can not be classed as true survey charts but they nevertheless show accurately the location of all the roads. They also disclose a wide discrepancy between the 65,311 miles estimated as the total county road mileage by county officials in 1926 and the 45,090 miles actually counted in the survey. However, 2,645 miles of county roads were transferred to the state highway system in the four-year period, leaving an actual discrepancy of more than 17,500 miles. The survey was begun about Aug. 1, 1930, field work was finished in October and the maps were complete in less than six months.

Because of short time for the work, short-cut methods were adopted in getting the mileages. There were available for almost all counties, U. S. Soil and U. S. Geological Survey maps of various dates, which showed all roads in existence at the date of survey. With these maps, as a base, parties from the nine district offices of the state highway commission traversed by automobile every public road in each county, making speedometer records of the length of each road, its type of construction and its classification according to its general traffic importance in the county system. The counties have an average area of 487 square miles. Each map was reviewed at the central office of the commission and connecting roads were brought into agreement at county lines.

Maine is Not Alone

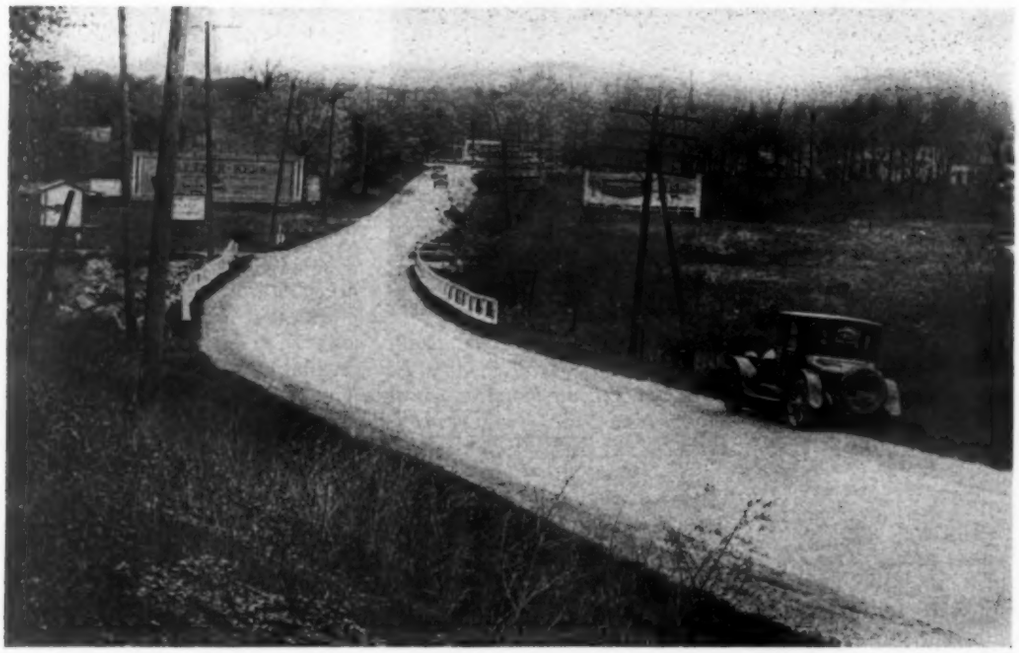
Warren: I have been driving a 26-mile route, 4 hard surfaced, 10 graveled and 12 just plain mud for nearly nine years. The first 4 miles are plowed after each snow storm. The next two are never touched. Then five more of plowed, three unplowed, four plowed and six are scratched over after a fashion; the last two are plowed.

This kind of route requires two horses to be kept at two different points of the swing as it is impossible to change from auto to sleigh to wagon to auto all in one trip. Eventually the whole equipment would be in one place; in other words this would be bad. In mud time (two months) two horses are absolutely necessary to cover 20 miles of this route—and we have mud in this country—thus my equipment consists of one automobile, two horses, sleighs, harnesses, wagons and all the other necessary incidentals that are required to go with these different means of transportation, all for $2,100.

I also have a wife and boy to support and need a little something for myself—insurance, rent, light and heat are quite needful at times. At the end of the year what have you? If I drove horses the whole year my expenses would be much smaller, but it simply means poorer service and that is just what my patrons do not want.—*National Rural Letter Carrier.*

Lost Time on Concrete Paving Jobs.—Careful studies on more than 100 concrete paving projects by the Division of Management of the U. S. Bureau of Public Roads showed that an average of 17 per cent of the time during which the construction crew was on the road ready to work was lost because of insufficient supply and faulty operation of the hauling equipment.

BEFORE



TWO views of Blue Mound Road in Milwaukee and Waukesha counties, Wis., prior to its conversion into a modern superhighway. This road penetrates an important metropolitan area, and rapidly increasing traffic made the narrow width intolerable. Traffic counts showed the necessity of furnishing relief through additional width.

AFTER

BLUE MOUND superhighway, showing two-lane construction (ultimate section two 40-ft. pavements separated by parkway) and full-width section, used where sufficient right-of-way could not be obtained. Easy transitions connect the full and two-lane sections. The improvement has rapidly won the approval of the traveling public.

Retread Work with Asphalt Emulsion

By MILLER BIDDLEMAN
Superintendent, County Road Commission, Leelanau, Mich.

During 1930 Leelanau County placed 111,747 sq. yd. of 1-in. bituminous retread on its county roads, the base of which was well maintained gravel metal. In doing the work we used a quick-setting asphalt emulsion, with ¼ to ⅝-in. pea-gravel for the aggregate.

To retread with the use of asphalt emulsion requires a little different method as to application than when using hot material, as it is applied cold.

Method of Constructing Retread.—First, the surface of the road was bladed thoroughly to shape and made smooth, after which it was cleaned of all dirty and loose material. The road should be given special care in maintenance the year previous to keep the road smooth and up to proper cross-section, as this has a great deal to do with the finished riding surface of this type of road. Second, all weak and low spots are to be repaired and brought up to proper cross-section before the retreading is started. The surface is now ready for the aggregate.

We first placed ½ in. of the pea-gravel aggregate uniformly on the road and watered freely ahead of the distributor, so that when the emulsion was applied it coated each stone more evenly and aided in proper penetration. After watering the first application, the emulsion is applied at the rate of ½ gal. per sq. yd., and then rapidly follow up with another ½ in. of pea-gravel on the freshly-applied emulsion. See that this application of stone is spread evenly and then start to roll the surface with either 5 or 10-ton rollers, and keep on rolling continuously for the next 10 hours or more to key the surface tight and evenly. The first application is done on 1 mile or more before starting the second and final application, so that unity of work can be carried on, and to have the base sufficiently bonded and partly set to insure against breaking the base with the aggregate of the second application.

The Final Application.—The second and final application is made by again watering the surface and following that up with the second and last application of ⅓ gal. of emulsion per sq. yd. Immediately follow the emulsion up with just enough fine aggregate to cover the surface, and roll again continuously for another 10 hours or more.

It is necessary that the road be rolled continuously while in the initial setting to insure proper bonding of the materials and to get a smooth-riding surface. Traffic can be allowed to travel over the newly-laid road each night should it be absolutely necessary with special precaution not to drive over a speed of 10 m. p. h., so that the material will not be crowded while in the soft stage, thus making slight ruts which are very hard to iron out on such fast-setting material as this.

It is better to keep traffic off the road at least one day until the road is partly set and then let light traffic over at a speed not to exceed 25 m. p. h. and with the caution not to apply brakes quickly, which might injure the surface by the skidding action of quick brake appliance, to help iron the surface down before it is fully set. Light traffic over the road in the last stages of setting with the above-mentioned precaution is essential to bind and thoroughly key the small stones to the surface and to make a smooth, tight surface.

The following is a summary of the average amount of material and the cost to us for this work:

Average number of gallons of bituminous material used	102,938
Average number of gallons of bituminous material used per square yard	0.92
Number of square yards of surface laid	111.747
Average cost per square yard	$0.2656
Average cost per mile, 18 feet wide	$2,804.74
Average material haul on aggregate	7½ miles
Number of pounds of pea-gravel used per square yard	102

New Method of Construction.—Our specifications and method of application with our present experience with emulsion will be changed somewhat. We will use graded, screened and crushed aggregate instead of pea-gravel as used this past year. It takes more bituminous material to coat, penetrate and positively bind the pea-gravel, there being so many small stones in the poundage used per square yard. However, very good results were obtained with the pea-gravel.

In using emulsion again we will grade our aggregate in three separate grades as follows: First or base course will be applied at approximately 70 lb. of screened, crushed and washed aggregate per sq. yd., the aggregate passing 1-in. screen and retained on ⅝-in. screen. This will be followed by emulsion at a rate of ½ gal. per sq. yd. and the second application of aggregate amounting to 22 lb. per sq. yd., which aggregate shall have passed over ⅝-in. screen and retained on ⅜-in. screen.

This second application of ⅝-in. to ⅜-in. screened and crushed aggregate will thoroughly fill all the voids in the ⅝-in. to 1-in. first course and thoroughly bind and key the base surface, which will result in less crowding and a more uniform depth and waterproof surface. The aggregate used will be over 50 per cent crushed material. After the second application of aggregate, which is ⅝ to ⅜-in. material, we will make the second application of emulsion at the rate of 4/10 gal. per sq. yd. and immediately follow that with our final application of fine aggregate amounting to 10 lb. per sq. yd. This fine aggregate for top is to pass ⅜-in. screen and be retained by ¼-in. screen. This will give a fine aggregate for final keying and will make a smooth-riding surface. To summarize, the three grades of aggregate will be as follows:

First course, 1 to ⅝-in. material, 70 lb. per sq. yd.

Second course, ⅝ to ⅜-in. material, 22 lb. per sq. yd.

Third or top course, ⅜ to ¼-in. material, 10 lb. per sq. yd.

These are approximate quantities and will vary somewhat in practice. The method of watering and rolling will be as previously mentioned.

We will also change the method of the appliance of the base and top. We believe that a better keyed and more waterproof road can be obtained by applying the base of the entire project first before making the last or final application. In this way sufficient time will elapse to give the base sufficient rolling which is very essential with help of traffic to compact and set the base course thoroughly before the final application of fine aggregate is made. Also any weak spots in the base will show up under rolling and traffic, and can be repaired.

Acknowledgement.—The paper above was presented at the 1931 Highway Conference at the University of Michigan.

LOW BIDS ON NEBRASKA ROAD JOBS.—At a letting by the State Highway Department of Nebraska on March 20 the bids averaged 10 per cent below the engineers' estimates. This was a $3,000,000 letting, the second this year on the $9,400,000 program for 1931.

Replacing LOST Surfacing Material

ON UNTREATED GRAVEL ROAD SURFACES

By LEON F. WALKER

Superintendent of Highways, Crawford County, Ill.

THE most expensive item of gravel road maintenance is resurfacing or the replacement of lost surfacing material. It is necessary, therefore, that every effort be made to increase the efficiency of doing this class of work. Methods should be employed which will assure the delivery of the best class of material on the road at the lowest possible cost.

In Crawford County, Ill., it has been found that resurfacing can be done most economically by letting the work by contract to the lowest bidders. The work is divided by patrol sections, which are usually from 3 to 6 miles in length. The contractor bids a unit-price per cubic yard on each patrol section. The contract specifies that a certain number of cubic yards of gravel shall be spread on the road surface uniformly from one end of the section to the other. The amount of gravel is usually 200 cu. yd. per mile. The contractor is required to furnish, haul and spread the gravel. The gravel must conform to the specifications of the Illinois Division of Highways, which among other things require that not more than 25 per cent of the material shall pass through a No. 4 sieve, and that for resurfacing not less than 100 per cent shall pass through a ½-in. sieve.

The gravel used in Crawford County is pumped from local pits along the Wabash River, which is the east

DAILY GRAVEL REPORT

Gravel Pit _____ Date _____ 1930

Gravel Hauled to _____

MECHANICAL ANALYSIS OF MATERIAL

Total % Passing - Each Hour 7 a. m. to 5 p. m.

SIEVE	7	8	9	10	11	12	1	2	3	4	5
1½											
1											
¾											
⅜											
No. 4											
No. 8											

Hours at Pit _____

Signed _____
Material Inspector

Fig. 1—Postal Card Mailed Each Day by Gravel Inspector

CRAWFORD COUNTY, ILLINOIS
OFFICE OF SUPERINTENDENT OF HIGHWAYS

INSPECTOR'S REPORT
TRUCK BED MEASUREMENTS

LICENSE NUMBER OF TRUCK	NAME OF DRIVER	LENGTH INCHES	WIDTH INCHES	DEPTH INCHES	* CAPACITY OF BED CUBIC YARDS

DATE _____ SIGNED _____ INSPECTOR

* NOTE: DO NOT WRITE IN LAST COLUMN.
FOR IRREGULAR SHAPED BEDS, SHOW MEASUREMENTS ON THE BACK OF THIS SHEET.

Fig. 2—Form on Which Truck-Bed Measurements Are Recorded

boundary line of the county, and it is hauled from the pits by truck to all parts of the county. An inspector is kept at the pit to make tests of the gravel as it is loaded into the trucks. He is responsible for seeing that no load leaves the pit which does not conform to the specifications. He is required to fill out a daily report card, Fig. 1, showing the mechanical analysis of the material at each hour during the day. The card is mailed by the inspector at the end of each day and reaches the office on the following morning.

The contractor is paid for his work by the cubic yard of material delivered on the road, and the number of cubic yards is determined by the measured volume of the truck beds. The pit inspector is responsible for measuring all truck beds and is furnished with a form, Fig. 2, on which to record these measurements. The computation of truck-bed capacities is simplified by the use of a chart, shown in Fig. 3.

On the road the regular patrolman acts as inspector. He is responsible for seeing that the gravel is properly distributed on the road and is responsible for keeping a record of the number of loads hauled each day by each truck. He is furnished with a form, Fig. 4, on which to record the number of loads hauled each day by each truck.

Unit prices paid for resurfacing work during the past year are as follows:

Average Haul, Miles	Price per Cu. Yd.
3	$0.94
9	1.15
13	1.35
15	1.40
15	1.49
18	1.60

This work was advertised, sealed bids were received and contracts were awarded to the lowest bidders. The unit prices given above covered the furnishing, hauling

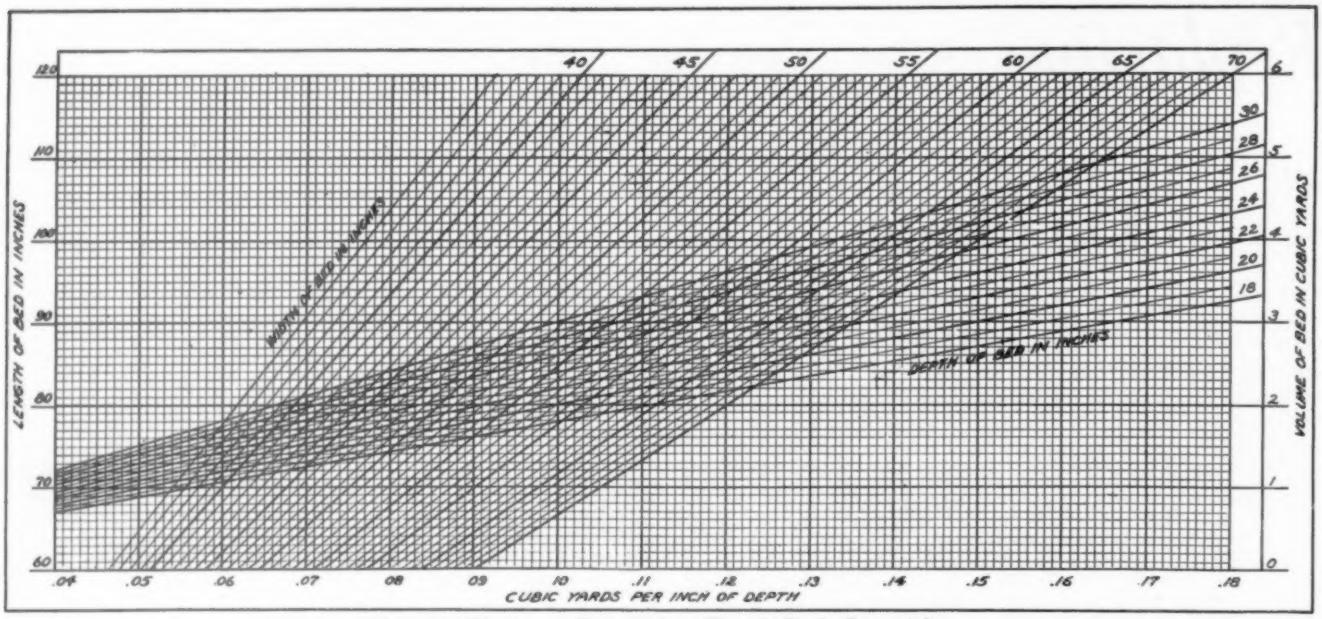


Fig. 3—Chart to Determine Truck-Bed Capacities

To illustrate the use of the chart, suppose that a truck bed has the following dimensions: length, 81 in.; width, 43 in.; depth, 27 in. Locate 81 on the vertical scale at the left-hand side of the chart; from this point follow the horizontal line to its intersection with the width-line 43; from this intersection follow a vertical line to its intersection with the depth line 27; from this intersection follow a horizontal line to the right-hand side of the chart, where the volume in cubic yards is given on the vertical scale.

and spreading of the gravel. Most of the trucks hauled from 1½ to 2 cu. yd. of material, while a few hauled 2½ cu. yd. The material was washed gravel, screened so that between 10 and 25 per cent passed through a No. 4 sieve. The gravel was loaded into trucks from bins by means of chutes, and it was spread on the road by means of adjustable end gates on the truck beds. The cost of inspection averaged 6 ct. per cu. yd.


CRAWFORD COUNTY, ILLINOIS
OFFICE OF SUPERINTENDENT OF HIGHWAYS

YEAR _____
ROUTE _____
SECTION _____

INSPECTOR'S REPORT
LOADS OF GRAVEL DELIVERED

LICENSE NUMBER OF TRUCK	NAME OF DRIVER	NUMBER OF LOADS EACH DAY						* TOTAL NUMBER OF LOADS	CAPITY OF BED CU.YDS.	TOTAL NUMBER OF CU.YDS.
									TOTAL NUMBER OF CUBIC YARDS	

SIGNED _____ INSPECTOR

* NOTE: DO NOT WRITE IN LAST THREE COLUMNS

Fig. 4—Form for Recording Number of Loads of Gravel

Farm Roads and Wheat Prices

Ever since its inception the Federal Farm Board, in its effort to stabilize prices for agricultural products, has been buying wheat with public funds. Recently wheat prices took another drop and the board now has on hand millions of bushels which are worth far less than it paid. Over-production of the commodity increases. Ex-President Coolidge remarks, "We shall learn through experience that that kind of farm relief will not work."

There is, however, one kind of farm-relief program that will work—that which looks toward providing agriculture marketing facilities. One of the preeminent factors in such a program must be the construction of farm-to-market roads in every farming state.

The American Farm Bureau Federation has pointed out that at present an overwhelming majority of our farmers are cut off from their market during several months of each year by impassable roads. They are isolated from civilization almost as definitely as if they were in the interior of Africa.

Modern methods make it possible to build long-wearing secondary roads at a comparatively low cost. Agriculture, the most necessary of all industries, must have them to progress and prosper.—*Athens, Ohio, Messenger.*

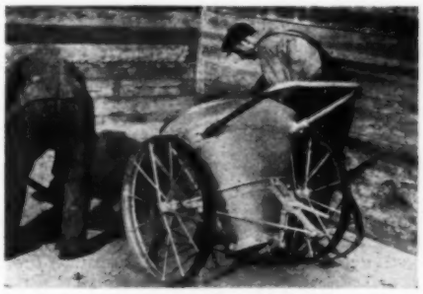
Maine Contractors Form Association.—The Maine Highway and Bridge Contractors Association was organized recently at Waterville, Me. E. C. Wilson is president, L. W. Smiley is vice-president and L. P. Barton, 76 Main St., Waterville, is secretary-treasurer. A majority of Maine public-works contractors have already joined and are cooperating in a program to better relations between and among contractors, and to improve contracting conditions on road and bridge work.

Average Haul on Concrete Road Jobs.—On 122 concrete paving jobs on which trucks were used for batch hauling, the average length of haul was 2.65 miles.

New Equipment and Materials

Cart for Handling Bulk Cement

A cart designed especially for handling bulk cement is a recent product of the C. S. Johnson Co., Champaign, Ill. The cart is of galvanized steel construction and has pneumatic tired or steel wheels. The cart has a toggle locked valve which provides a bottom discharge which, when used with a canvas spout, avoids the splashing and blowing of cement caused by dumping a



Johnson KoneKart

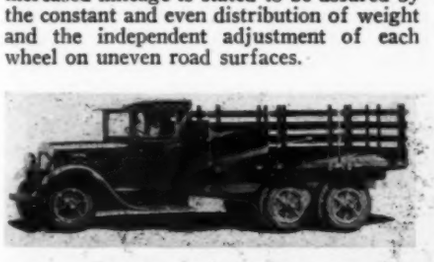
tip-over cart into a truck compartment. The valve is tripped by a foot lever and the cement pours into the compartment smoothly and evenly. Filling is speeded by the large top opening and the support which permits tilting the cart and lowers the shoveling height.

The cart is made in three sizes, Models 6, 7, and 8, to take care of varying mixer batches.

New 3-Ton, 6-Wheel Truck

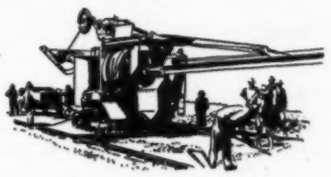
A new 6-wheel, 6-brake truck has been added to the line of the Federal Motor Truck Co. This 6-wheel model features improved riding comfort and road-cushioning qualities made possible by a flexible construction which allows either axle assembly, the individual wheels on either side to move up and down independently. The rear wheels are mounted on two pairs of rear springs (one pair on each side) and the Federal design provides a proper weight distribution on all six wheels.

The use of hydraulic brakes on all six wheels as standard equipment is an outstanding features of the new Federal. And increased mileage is stated to be assured by the constant and even distribution of weight and the independent adjustment of each wheel on uneven road surfaces.



New Federal 3-Ton 6-Wheel Truck

The new Federal 6-wheel chassis is produced with either a 4 or a 6-cylinder engine. Both engines are of the L-head type —the four cylinder engine developing 48 hp. at 2500 r.p.m., and the larger one developing 60 hp. at 2600 r.p.m. Three-point suspension, silent chain timing drive, pressure feed lubrication, water pump at side of cylinder block, air cleaner, fuel pump and oil filter are added features of both engines.



Chassis features include 4-speed, selective sliding gear transmission; heavy 6-in. pressed steel, channel type frame; and full-floating, forward rear axle.

This new 6-wheeler is a complete All-Truck unit of transportation designed and built entirely by Federal. It is offered in four different wheelbases, the four cylinder engine in 140¼ in. and 164¼ in. lengths, and the six cylinder engine in 144¾ in. and 168¾ in. lengths.

New Motor Patrol

A new road maintenance machine has been added to the line of the Caterpillar Tractor Co., Peoria, Ill. The machine has four speeds forward: 1.8 miles, 3.7 miles, 6.5 miles and 10 m.p.h.; and a 2.3 m.p.h. reverse.

The steering wheel is the only control operated manually. The other controls are conveniently located in front of the operator and effect the raising and lowering the scarifier, raising and lowering the blade, swinging the circle and shifting the blade from side to side. The power for these controls is supplied through a proper take-off from the engine.

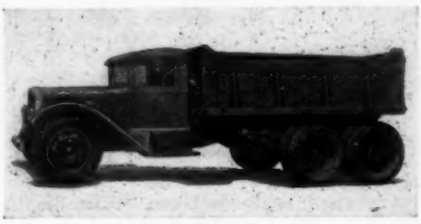
Caterpillar Auto Patrol

The 35-hp. engine is mounted in the main frame, behind the operator's seat. Power from the engine is conveyed through the power take-off and controls to the mechanical operation of the blade and scarifier, and through the change-speed gearing to the rear axle and the rear wheels, which bear 40x8-in. dual pneumatic tires. Brake control is simple and effective. The brake pedal applies powerful braking action through a drum on the lower transmission shaft.

Supplied as standard equipment is electric lighting equipment, including two white lights, red tail light, generator and battery. The scarifier is an item of extra equipment—also available as extra equipment is a set of panels for converting the canopy top into a cab.

Sterling Announces New Line of Motor Trucks

An entirely new line of motor trucks has been announced by the Sterling Motor Truck Co., Milwaukee, Wis. The line includes 29 distinct models of various capacities from ¾ to 12 tons, in a broad array of wheelbase lengths in bevel, worm, double reduction, chain and dual drives for commercial and dump hauling. In addition to embodying many new mechanical developments, the appearance of the trucks has been greatly enhanced, adding beauty and symmetry of lines even in the heaviest capacity models. Such refinements as V-type radiators with wind deflectors, long sweeping crown fenders, hinged hood louvres, elaborately finished instrument panels, and de luxe cabs with adjustable seats and backs are apparent in the various models. The special chassis design of the heavy duty models makes them readily adaptable to 6-wheel attachments.

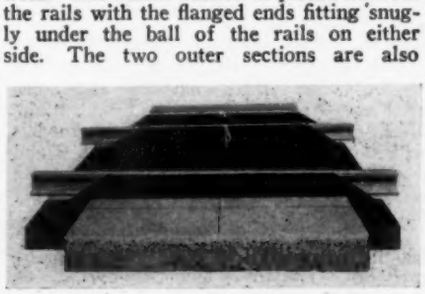


Sterling Heavy-Duty Unit with a 7-Yd. Dump Body

New Steel Sidewalk Crossing for Railroad Intersections

In harmony with the efforts of railroads to prevent accidents at intersections, Joseph T. Ryerson & Son, Inc., Chicago, Ill., have recently perfected an all-steel safety crossing for pedestrians.

The design of this new product was made after a comprehensive survey of accidents and their cause. Every possible safety measure has been incorporated as a result of this survey. Another feature of interest is the sturdy construction which eliminates practically all maintenance expense. The new crossing is constructed in three units, the center and two outer sections. The center section is placed between the rails with the flanged ends fitting snugly under the ball of the rails on either side. The two outer sections are also flanged under the ball of the rails, and when placed in position they form a span level with the rails and the sidewalk. The channels and zees which make up the under part of the crossing, rest directly upon



Ryerson All-Steel Sidewalk Crossing

the ties, assuring the same level walking surface at all parts of the crossing.

In the process of manufacture the ends are formed downward. When the crossing is installed these ends serve to hold the entire crossing in place as they are spiked firmly to the ties. With the ends sloped to the ties and fastened securely in this manner, dragging brake beams, dangling chains, etc. on moving trains cannot catch on the crossing.

It is stated that less than 30 minutes are required to completely install or remove the crossing. The three sections are merely placed in position and spiked to the ties, or the spikes are easily taken out and the sections lifted when removal is desired.

Installations of the Ryerson all-steel foot crossing have already been made in Chicago, and several contracts recently received by the Ryerson Co., indicate an increasing demand for this new product.

A New ½-Yd. Shovel

A new full-revolving, fully-convertible, ½-Yd. shovel has been placed on the market by the Pontiac Tractor Co., Pontiac, Mich. Some details of this machine follow: Length of crane boom, 30 ft., 35 ft., 40 ft.; length of shovel boom, 16 ft.; length of dipper handle, 10 ft. 6 in.; rotating speed 7 r.p.m.; overall width, 8 ft. 6 in.; overall length, 10 ft.; overall height, 10 ft. 2 in.; approximate weight 28,000 lb.; maximum shovel dumping height 14 ft.

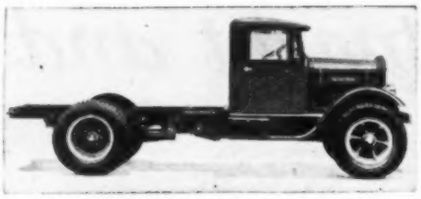
The Wright Excavator

The hoist is made by removing the entire rear axle and differential of the McCormick Deering Model 20 industrial tractor and substituting a chrome-nickel shaft mounted on four brackets with Hyatt roller bearings. The swinging gears are two 18-in., 45-deg. bevel gears mounted on the cross shaft between the bearings. Each is actuated by self-energized cone clutches, one rotating the shovel in one direction and the other in the opposite. The entire shovel mechanism has only three pairs of gears.

New Truck Line Announced

A complete new line of flexible medium and heavy duty trucks has been announced by Pierce-Arrow Motor Car Co., Buffalo, N. Y. These new units include five models with a range of 12,000, 18,000, 24,000 and 34,000 lb. vehicle gross weight, as well as a special 34,000 lb. 6-wheeler for extra heavy duty.

The new 2-ton (12,000 lb.), 3-ton (18,000 lb.) and 5-ton (24,000 lb.) units are each offered in three wheelbases: 160, 180 and 200 in. for the 2-ton and 5-ton series, and 150, 170, and 190 in. for the 3-ton chassis. The 8-ton (34,000 lb.) unit is offered in two wheelbases—168 and 204 in. Save for capacity, wheelbase, frame dimensions and double rear wheels, specifications of the 6-wheeler correspond to the specifications of the 5-ton chassis.



New Pierce-Arrow 5-Ton Truck Chassis with Cab

Engines throughout are 6-cylinder L-head type of Pierce-Arrow design and varying power. Bore and stroke are 3¾x4½ in. in the 2-ton chassis; 4⅛x4½ in. in the 3-ton; 4⅝x4¾ in. in the 5-ton and 4¾x5¾ in. in the 8-ton, giving engine displacements of 298 cu. in, 361 cu. in., 479 cu. in., and 611 cu. in. respectively. Power is 70 hp. for the 2-ton unit; 77 hp. for the 3-ton; 103 hp. for the 5-ton and 130 hp. for the 8-ton.

Cast iron pistons and connecting rods are matched in sets for perfect balance. Valves are of specially selected steel. The heavy crankshaft, drop forged from selected steel, is statically and dynamically balanced, and carried in seven large bearings with extra heavy crank cheeks. Diameter of the crankshaft is 2⅝ in., with a bearing length of 13¼ in. in the 2-ton and 3-ton chassis. In the 5-ton and 8-ton chassis, diameter of the crankshaft is 3 in. and 3½ in. respectively, with a bearing length of 15 in. and 16⅝ in. respectively.

Engine and transmission are combined in one unit on the 2-ton and 3-ton chassis. All other models mounted amidships. The engine is supported at the rear in strong frame brackets, and in front in a sturdy arched steel trunnion, which provides essential flexibility yet assures rigid three point suspension. Distributor, generator and starter are mounted on the engine. An engine governor is standard throughout. Dual ignition, consisting of two complete firing units which provide maximum fuel efficiency and greatly increased power, is used in all chassis with the exception of the 2-ton series. Fuel, oil and air filters render engines absolutely dirt-proof.

A Multi-Motor Truck

A new type of truck introducing the multi-motor principle has been announced by the Relay Motors Corporation of Lima, O. It is a dual-engine, 6-wheel, heavy duty model.

The new truck is equipped with two straight eight cylinder truck type engines with a combined power of 275 brake horse power at 2800 r.p.m. The power is applied to the drive in a new way. Each engine delivers power to separate Relay rear axle.

The engines may be used in combination, or one at a time. Each engine has its own transmission. An air mechanism shifts the twin transmissions in perfectly synchronized time. One lever will shift both gears when both engines are in use. Two simple movements from the driver's seat connect or disconnect either engine.

The new model is equipped with heavy duty air brakes, with cast brake drums and moulded brake blocks on all six wheels, and air connections for trailers. Twin emergency brakes offer an added margin of safety in stopping.

New Linn Tractor

Many important improvements of construction are stated to be featured in the New Model Linn tractor of the Linn Manufacturing Corporation, Morris, N. Y. To give greater traction, each string of lags on the new model Linn (6-28-F) contains 29 units instead of 26 . . . giving approximately 300 additional square inches of track surface in contact with the ground, a total minimum gripping surface of 1,400 sq. in. instead of the former 1,100.

Three track springers in clover leaf formation with a stop pin in the track adjusting bar relieve the constant tension of the track on the rear driving sprocket when driving ahead. When operated in reverse at high speed, the track springs come into play, keeping the track tight so that the lags do not buckle or catch in the rear frame.

The new model also has a fuel pump in place of a vacuum tank; a new and improved type of high speed reversing transmission which connects directly with the clutch; continuous side frame channel and the new improved steering wheel worm gears.

The new Linn side-tipping elevating grader body doubles the dumping utility of Linn and combines ease of operation with simplicity and ruggedness of construction. It is equipped with an especially designed Commercial Shearing and Stamping three-sleeve hoist, which dumps either to the right or left, but not to the rear, and provides a tipping angle optional with one's need. Sturdily built automatic down-folding gates on each side raise, lower and lock into position automatically. When flush with the body, they permit an early release of the pay load and a clear passage for boulders and large chunks of dirt. A rim board, which may be used on right or left side of the body, depending on the position of the grader, gives additional loading capacity. The loading capacity is 8 cubic yards.

Of particular importance is the fact that the loading height of the new body is only 5 ft. 7 in. There is no projection on the rear of the body to bump the grader when the tractor is fully loaded and is driven out from under the grader. Another Linn body is also equipped with the new automatic down-folding tail gate. This new type tail

New Relay Dual-Engine Truck

gate, sturdily built and well able to withstand heavy weights and pressures is controlled from the driver's seat by a lever; it saves a man the trouble of getting out to raise or to lower it. Immediately as the body lifts, the gate begins to open and the pay load begins to spill out, relieving the hoists of stress and strain. In dumping, when fully open, it provides an absolutely free passage for the discharge of boulders, large chunks of dirt and similar materials. And in hauling operations, it can be locked flush with the sides of the body for the carrying of dirt, snow and bulky loads or locked fully open for the transportation of girders and logs.

New Traffic Signal Control

The American Gas Accumulator Co., of Elizabeth, N. J., has placed upon the market a synchronous motor driven, traffic signal control which is fully described in their latest literature. Among the claims made for it are ample power, quick make

Synchronous Motor Driven Traffic Signal Control

and break contacts, flashing amber feature with radio interference eliminator and simplified method of securing all standard color sequences.

The operation of a limited progressive movement of traffic without interconnecting wires when this control is used, is also described in their new catalog.

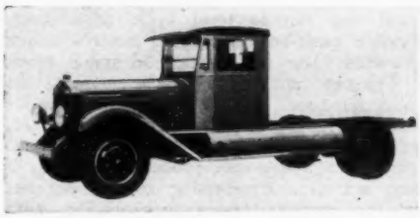
A Dual Purpose Compressor Truck

A compressor truck unit in which the engine that operates the compressor also drives the truck is now being marketed by the Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., in conjunction with the Sterling Motor Truck Co., Milwaukee, Wis.

By placing the entire Thor 120 cu. ft. compressor unit under the hood of the motor truck and using the engine to propel the truck, the 10 ft. space in the rear of the cab can be used with any type of body for transportation purposes; and when reaching destination the compressor can be put in operation to supply air for various types of pneumatic tools.

This unit is available in the 120 cu. ft. capacity compressor size and 2½ to 3-ton truck capacity only. The unit type construction of the compressor lends itself to this application without any radical changes. The compressor unit is provided with a flywheel bell housing to which a standard clutch and 5-speed transmission is attached, giving a conventional and direct drive to the rear axle. This unit is not a make-shift power "take-off" but specifically designed for a dual purpose.

The truck unit is supplied by the Sterling Motor Truck Co. Only the highest grades of materials are used in the construction of this unit such as Timken



Dual Purpose Compressor Truck

axles, Brown-Lipe clutch and 5-speed transmission, Spicer universal joints, 4-wheel Lockheed hydraulic brakes, Leec-Neville starting and lighting equipment, 34 in. x 7 in. dual tires on rear and 34 in. x 7 in. front. The compressor controls are located inside of the cab and the air receiver is mounted on the running board.

Due to ample horsepower of the engine, 30 miles per hour road speed is stated to be easily attained at only 1000 R.P.M. of the engine. The maximum truck speed is governor controlled. A very ingenius control arrangement has been worked out so that the truck and compressor operation are independent of each other and when the compressor is functioning, the speed is governed to the usual 800 R.P.M.

All Welded Construction and New Tandem Drive for Adams Motor Graders

J. D. Adams Co., has announced that all Adams motor graders are now of electrical welded construction throughout. The company also announces a new tandem drive, with four driving wheels for Adams motor graders.

Three advantages claimed for the Adams tandem drive are: First, equal weight is carried on all four drive wheels which pivot around the tractor axle, giving each drive wheel equal traction. Second, the front end of the tractor is supported in the grader frame, thereby utilizing a considerable portion of the tractor's weight as effective weight on the blade. And third, all drive chains, sprockets, and bearings are completely enclosed in dirt proof housings, greatly increasing the life of all these parts. Each drive wheel is driven by a separate roller chain, and the tractor and the wheel axles are mounted on ball and roller bearings.

Tires for the Adams tandem drive are 40 in. x 8 in., 12 ply heavy duty pneumatics. They are furnished with puncture proof tubes. These tubes are stated to eliminate the question of flat tires from punctures, because they are self sealing. The special rubber of the tube presses tightly against the penetrating object, retains air and closes the hole when the object is removed, with no loss of air pressure. They are said to practically eliminate motor grader tire trouble.

Adams motor graders are furnished with McCormick-Deering, Allis-Chalmers, or Case tractor power units, and with solid tires, with pneumatic tires in the single or tandem drives, and with steel or rubber crawlers. The new Adams catalog No. 31 completely illustrates and describes Adams motor graders and the new tandem drive. A copy will gladly be sent on request to J. D. Adams Company, Indianapolis, Ind.

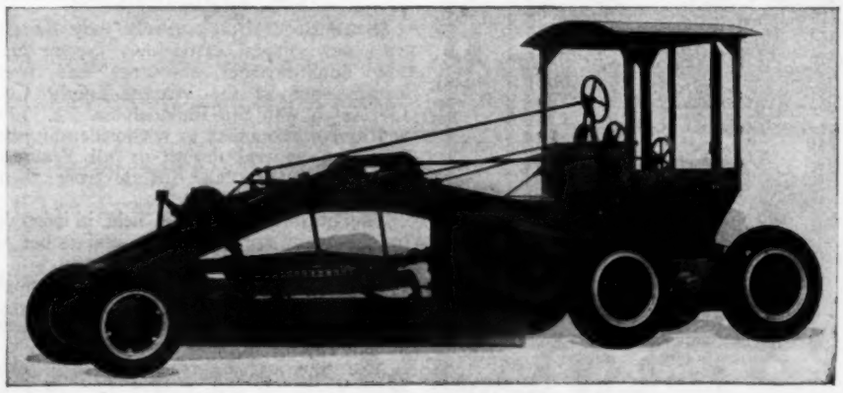
New Scarifier Works Close to Obstructions

Combining two extra teeth with extra width which gives ability to work right up to the edge of banks, buildings, fences or other obstructions, a new hydraulic scarifier, has been added to the line of hydraulically-operated tractor equipment manufactured by the American Tractor Equipment Co., Oakland, Calif., and Peoria, Ill. Ateco tractor equipment is factory-engineered to team up with Caterpillar tractors on earth-moving work, and is sold throughout the world by Caterpillar dealers.

New 7-Point Scarifier

This new scarifier is ruggedly built to stand up under the roughest kind of work. The frame is made of electric cast steel to which are firmly bolted seven steel shanks for holding the scarifier teeth. These teeth are hydraulically controlled to work to a maximum depth of 24 in. The scarifier rolls on the standard Ateco steel disk wheels equipped with the regular dirt guard.

The extra width of the frame places the outside tooth beyond the scarifier wheel and even 11 in. outside the line of the tractor tracks when the extreme offset hitch is used. This feature makes it possible to work close to all obstructions.



Adams Motor Grader

Metal Curb

A metal curb has been placed on the market by the American Rolling Mills Co., Middletown, O. This curb was developed by W. H. Moseley. The system consists of a pair of smooth metal curbs, connected by frequent tie-rods, gauged for the width of the finished pavement. The design employs the rocker-arm principle. The tie-rod is fastened near the mid-point of the curb, with the old road base beneath and the new surfacing above. As outward pressures bear on the upper portion of the curb, during construction of the new surface and later from the side thrust of traffic, the tie-rod holds the curb at the rocker point, so that equal and opposite pressures bear on the old roadbed.

The Armco metal curb is furnished in standard 20-ft. lengths, 6 in. in width and ¼ in. thick, with holes punched ready for the tie-rods. Ten-foot lengths can be supplied for sharp vertical curves. Alternate types of ties are available. They may be ½-in. round rods with a standard thread on one end and the other end bent down, or with both ends threaded. Two nuts are furnished on each threaded end, one for the outside of the curb and one to lock against the inside. The nuts on the rods protect the threads during transit. The rods are threaded sufficiently to allow close adjustment to the desired width of roadway between curbs. For another type of tie-rod design the curb is furnished with slotted holes, slightly tapered. The tie-rod is a flat 1x¼-in. strip with square notches near each end. After the strip is inserted in the slot in the curb, and one of the notches is engaged, the wedge punched from the slot is driven in alongside the tie-strip. This wedge holds the curb firmly during construction, and insures a tight, strong joint.

New Traffic-Control Timer Meets Varied Demands

A new type of traffic-control timer, has been introduced by the General Electric Co. The new timer can be used at isolated intersections, for limited progressive traffic movement, non-interconnected and for flexible progressive traffic movement in an interconnected system.

The various features in this timer, include complete color sequence flexibility, local and remote total cycle adjustment, flexible push-button manual control which prevents false indication, and triple reset.

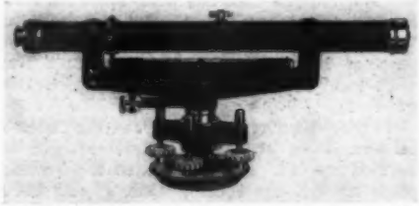
Traffic-Control Timer as Supervising Control Box

The new unit has the cycle range of the induction timer, a new type of synchronous motor drive that is 150 times as powerful as the usual one, a 15-step gear shift instead of a 5-step one, provision whereby it may act as a supervising control for the system, means for resynchronizing with the supervisory timer once each cycle, and provision for handling up to eight periods and nine circuits.

Three-street and special intersection controls may be provided by a slight factory modification of the standard control. The unit is housed in a cast-iron weatherproof cabinet adapted to pole or pedestal mounting. It has provision for flashing amber, red and amber, or flashing red, as well as steady red and manual control. The timer is jack-mounted and fastened on a shelf so that it can be lowered out of the box and easily inspected or replaced without the use of tools.

New Contractors' Level

A new 18-in. dumpy level has been developed by the David White Co., Inc., Milwaukee, Wis. The instrument was designed principally for highway engineers and building contractors and is built for hard usage and rough handling. It is easy to adjust and will stay in adjustment under severe conditions, according to the manufacturers.



Improved 18-in. Dumpy Level

The leveling screws are larger than on the standard instrument and they are knurled instead of finely-milled screws. Engineers using the new instrument are able to turn the screws with gloved hands with ease. The leveling screws also are equipped with dust caps.

The new internal focusing arrangement of the new level was developed after many years of research. The magnifying power of the telescope is 35 to 40 diameters. The instrument has a new, durable finish which is attractive as well as durable. It is furnished with a heavy, split leg tripod with spur shoes.

New Transit-Level

A transit-level of entirely new design, with new optical instrument system and new dual bearing standards has been brought out by the Warren-Knight Co., 136 North 12th St., Philadelphia, Pa. The instrument resembles to a considerable degree, the general design of all Warren-Knight transits, but differs from them principally as follows:

The horizontal circle is held in position by automatic spring tension and is set to the zero reading by hand.

The telescope cannot be plunged through the standards.

The telescope is provided with bell metal collars similar to those on a wye level.

The tops of the standards form dual bearings—a V and a wye in each—the telescope axle being normally held in the

Warren-Knight Transit-Level

V-bearings by spring clips, with provision for instant release.

The telescope and axle can be lifted out of the V-bearings (the normal working position) and the telescope rested in the wye bearings for checking the adjustments in the same manner as a wye level.

New Heavy-Duty Socket Wrench Set

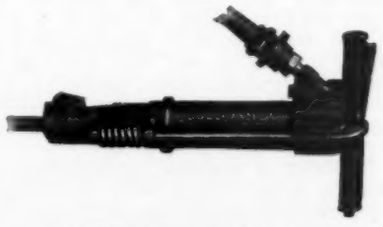
A socket wrench set designed especially for repair or assembly work on trucks, tractors, graders, pavers and other machine units, has been announced by the Blackhawk Mfg. Co., Milwaukee, Wis.

The set consists of one heavy duty ratchet, sliding offset, two extension bars, 8½ in. and 17 in. long, "lock-on" release key and nine double-hexagon sockets ranging from 1 in. to 1⅝ in., all packed in a sturdy steel case.

New Concrete Breakers

The Sullivan Machinery Co., 400 N. Michigan Ave., Chicago, Ill., has brought out two new improved concrete breakers, as follows: K-5 72-lb. 25¼ in. long, overall; K-6 80-lb. 28½ in. long, overall.

The K-5 buster is intended for all ordinary work, while for unusually heavy conditions such as smashing the hardest steel reinforced concrete, the K-6 with striking block or anvil construction is available.



Sullivan Concrete Breaker

In these tools, emphasis has been laid on simplicity, rugged construction, cutting power and ease of handling. A new feature is the novel design of front head and steel retainer. This retainer is of the cam type without springs or trunnion, and enables the steel to be locked easily by hand or foot pressure, holding it rigidly in position, but permitting quick and easy release when desired.

"The Faster the Time the Better the Times"

THE character of a community—the way its people live and do business—is influenced as much by the roads outside it as by the streets within it. Widen, straighten, or resurface a highway and immediately the road is used more. The whole community responds.

Farmers deliver better crops and better live-stock because they're in closer touch with markets. Shrinkage losses and haulage costs are cut. And better times come to all members of a community when fresh fruits and vegetables are plentiful in local markets.

Projected road improvements materialize faster once a community discovers Tarvia "Re-Tread"—and the economical answer it provides to any highway problem. Whether you must reclaim an old road, replace dirt or improve gravel, rebuild or widen any highway, Tarvia "Re-Tread" fits the job and fits the budget.

The Tarvia field man will gladly give you the details. 'Phone, wire or write our nearest office.

The Barrett Company

New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
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Providence	Syracuse	Cincinnati
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Tarvia "RE-TREAD"

TRADE-MARK REG. U. S. PAT. OFF.

Distributor News

Edward R. Bacon Company Holds 21st Annual Sales Convention

That construction, as a whole, suffered less than any other basic industry during the late depression and that 1931 holds great promise were the keynotes when the heads of the sales and service divisions of the Edward R. Bacon Company recently gathered at the head office in San Francisco for the 21st annual sales convention.

The convention was opened Saturday afternoon by Mr. Bacon, who founded the company in 1910. Mr. Bacon traced the growth of construction in the far west and the parallel growth of his company, now one of the largest equipment distributing organizations on the coast. The remainder of the afternoon was devoted to discussion of the Boulder dam, Golden Gate bridge and other major projects. A banquet at the St. Francis Yacht Club was followed by the resumes of the last year by the divisional managers.

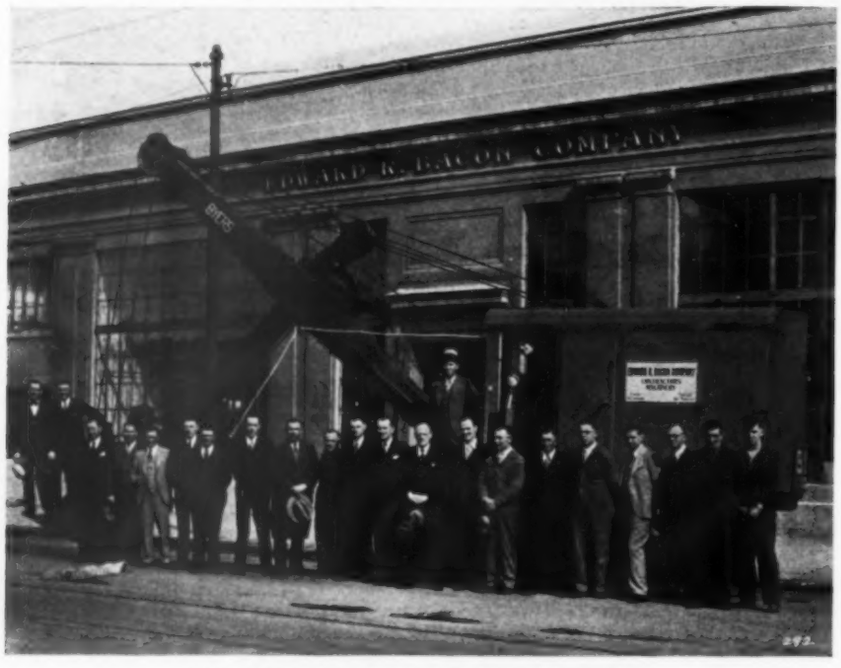
Recent developments in equipment and methods and plans for enlarging the scope of the company's service were the topics of Sunday morning. During the afternoon the entire group made an inspection trip to the Contractors' Machinery Exchange, in Oakland, a large subsidiary for the renting, selling and repairing of used equipment.

That the faith of this organization in the prospects for 1931 is sincere is perhaps best evinced by the addition of a new service department, that of lubrication maintenance —and that 1930 was successful, by the sales total for that year which closely approached the high mark set in 1929. The personnel remained intact during the past year, a fact which speaks well for the stability of the construction industry in the face of a general drop in production figures.

The Edward R. Bacon Company is typical of the growth and opportunities offered by the west. Starting with an office and warehouse only 3,200 sq. ft. in area, the company now uses over 100,000 sq. ft. in sales and show rooms, warehouses, parts, repair and shipping departments and yards for used equipment. Branch offices are maintained in Oakland, Sacramento, Fresno, Reno and San Jose, and Honolulu. Several types of construction equipment are manufactured under their trade name "Erbco" and the equipment of over fifty nationally known manufacturers is carried in stock.

An interesting sidelight is that the Jaeger Machine Company, in 1913, shipped to Edward R. Bacon Company the first carload of concrete mixers that ever left its plant. The Foote Company, manufacturers of Multifoote pavers, was the first manufacturer represented. Both of these manufacturers are included in their present list.

The Browning Crane & Shovel Company is the new name of the organization formerly known as the Brown Crane Company. It is said that the change was made because of the rapid development of their shovel business. In addition to shovels and cranes the products of this company include trench hoes, skimmer scoops and draglines, and it is stated that the manufacture of these products will continue under the same company personnel.



They Were All at the Bacon Sales Convention

Edward R. Bacon, in person, at the controls. Mr. Bacon is the president of the organizarion and beside him is A. B. Hartley, vice-president. The others reading from left to right: Don M. Hoffman, manager, Sacramento division; Paul W. Mohr, sales engineer; S. J. Clark, assistant sales manager; O. C. Bell, manager, Reno division; H. J. Learn, manager, Fresno division; F. Moran, secretary, Contractor's Machinery Exchange; S. B. DeHart, Sales engineer; Niles S. Colman, advertising manager; Sam Bates, superintendent, Contractor's Machinery Exchange; Frank Wies, transportation superintendent; W. M. McGouirk, sales manager; Claude L. Hunt, lubrication engineer; P. Stebinger, secretary and treasurer; W. J. Drury, service engineer; John Lyons, field service; Charles S. Jackson, manager, San Jose division; John Baumgartner, service department; J. Jorgensen, manager, Contractor's Machinery Exchange; H. G. Thiele, manager, Oakland division; Will Ronayne, service department; Frank Kern, shipping department.

Personnel Changes at Barber-Greene Co.

Several changes in the sales organization lineup for 1931 have been announced by the Barber-Greene Co. of Aurora, Ill., manufacturers of material-handling equipment.

E. H. Cooper, since 1927 manager of this company's office at Kansas City, has been appointed ditcher line head for the western division to operate with J. M. Bruns, ditcher line head for the eastern division. Mr. Cooper has been with the organization since 1925. In that year and in 1926 he was in Florida, where he was very successful in introducing the vertical-boom ditcher for subdivision work. Since joining with the Barber-Greene Co., Mr. Cooper has studied and worked with ditching problems especially, and has had very extensive experience with all types of ditching, particularly with pipe-line work in Oklahoma, Kansas and Missouri.

The territory formerly served by E. H. Cooper as manager of the Kansas City office is now divided between the Kenney Machinery Co., of 2301 Grand Ave., Kansas City, Mo., and the Buda Engine Service, of 521 West Archer St., Tulsa, Okla.

Two new branch managers are also announced by the Barber-Greene Co. They are Frank Ness, manager of the Philadelphia office, and D. H. McLean, manager of the office at Cleveland. Mr. Ness received his education at Clark University, Worcester, Mass. For five years he was at the Boston office of Barber-Greene, during which time he has received a very thorough and practical training in the construction and uses of their equipment. Prior to joining this company he spent eight years in the belting and power transmission industry, including six years with the Lewis E. Tracey Co., of Boston, and two years with the Fairbanks Co., of New York. Mr. Ness also served two years with the Base Hospital Unit No. 5, the first American outfit to go to France.

D. H. McLean, manager of the Cleveland branch office, was graduated from the University of Colorado in 1924 and after coaching football for two years joined Barber-Greene Co., entering the branch office at Detroit after several months' experience at the home plant. His training in the factory and field have equipped him to understand and solve material-handling problems.

New Eastern Address for Bay City Shovels, Inc.

Effective April 30, the eastern office of Bay City Shovels, Inc., of Bay City, Mich., will be moved from 302 Broadway, New York City, to 9 Westfield Ave.,, West, Roselle Park, N. J. The office at Roselle Park will be operated in conjunction with the eastern warehouse and service station of this company. E. P. Reading will continue in charge as eastern sales manager.

$2690 Now Buys Today's BIGGEST VALUE *in the* 4-5½ ton range

Model T-55—4 wheelbases, wide range of tire options available . . . full floating double reduction rear axle . . . 19,000 pounds, Straight Rating (total gross weight including load). Above price 155-in. wheelbase, chassis only, f. o. b. Pontiac, Michigan.

THIS brings General Motors Truck power, speed and strength to heavier duty road operations—*at a price $2000 less than the average price of 59 other trucks in this capacity range.* Lowered material costs and production economies are passed on to you.

This model is powered by the famed General Motors Truck heavy duty engine . . . 94 actual horsepower . . . 6-cylinder smoothness . . . more speed than you can use . . . ample reserve power for stiff grades, pits, gumbo or the toughest kind of going.

Every performance factor has General Motors Truck *proved* dependability, economy and long-life.

You've got a real thrill coming when you see this great performer in action. Get full facts about it. Compare it point by point with anything in its capacity range.

Telephone your nearest General Motors Truck branch distributor or dealer. *Get a thorough demonstration in your own work.* Telephone *today!*

GENERAL MOTORS GM TRUCKS

GENERAL MOTORS TRUCK COMPANY, Pontiac, Mich.
(*Subsidiary of* Yellow Truck & Coach Mfg. Co.)
GENERAL MOTORS TRUCKS, YELLOW CABS and COACHES.
Factory Branches, Distributors, Dealers—in over 2200 principal cities and towns. (*Time payments financed through* our own Yellow Manufacturing Acceptance Corporation, *at lowest available rates.*)

A PRODUCT OF GENERAL MOTORS

Byers Machine Co. Appoints New Chicago Distributor

The Superior Construction Company will distribute and service the complete line of 1⅛ to ½-yd. shovels, cranes, draglines, trenchers and skimmers for the Byers Machine Company, of Ravenna, Ohio. They will also handle the Byers excavator line of Model 40 and 50 small shovels and cranes.

The entire sales force of the Superior organization, including President Sostheim, recently visited the Byers factory for a week-end. They saw the complete line of machines in action out on the proving grounds, went through the factory on an extended inspection tour and later were given an intensive study course covering equipment, service and general company policies.

W. R. Sostheim, President of Superior Supply Company and H. C. Beckwith, President of Byers Machine Company, Shaking Hands on Their New Relationship. Mr. Sostheim and His Organization Will Represent Byers in the Illinois and Indiana Territory.

During the past eleven years the Superior Supply Company, headed by W. R. Sostheim, has successfully distributed a complete line of construction equipment to all divisions of the construction industry as well as to industrial plants, public utilities, railroads, municipalities, states and the government.

The large warehouse of the distributing company holds stocks of all the most popular equipment for immediate shipment from their own railroad siding. They are also in a position to rent all kinds and types of machines for short or long periods. The offices and plant are at 1850 South Kostner Ave., Chicago.

Reports From Schramm Air Race

February prize winners in the Schramm Air Races have been announced as follows:

1st prize, Harris Pump & Supply Company, plane Pittsburgh.

2nd prize, Smith-Booth-Usher, plane Southern California.

3rd prize, P. I. Perkins Company, plane Boston.

4th prize, Wheeler-Murray Company, Buffalo.

5th prize, Kern Limerick, plane Little Rock.

The distributing company placing first for the month of February, were the holders of third place in January and their combined mileage now places them in second place in the field. Smith-Booth-Usher looks as if they had entered the race with every intention of winning as they now command first place, having piled up a goodly number of miles to their credit.

A race is never over until the tape is crossed and as there are 69 distributors still in line a dark horse may be heard from yet.

Lidgerwood Appoints New Distributors

The Lidgerwood Manufacturing Company, Elizabeth, New Jersey, well-known hoist and derrick manufacturer, has been strengthening its distributor organization, according to a recent announcement.

Names new on their list of distributors, but well known in the industry, include Hedge & Mattheis Company, of Boston; the Brown-Bevis Company, of Los Angeles; the Edward R. Bacon Company, of San Francisco; Funkhouser Equipment Company, of Kansas City, and the Thorman W. Rosholt Company, of Minneapolis. Other names are to be announced in the near future.

Reports from the manufacturer state that during the past year a number of interesting features have been added to the Lidgerwood products and that the new "A" crane recently developed is meeting with favor.

United American Bosch Executives Return From Coast

Herman Waker, vice president, and James E. Redman, sales manager of the automotive general sales division, United American Bosch Corporation, of Springfield, Mass., returned yesterday from an extended tour of western states. They visited the automobile show in Chicago and were principal speakers at a series of meetings at Seattle, and Spokane, San Francisco, and Los Angeles, attended by owners of service stations operating under franchises of the former Robert Bosch Magneto Co. and the former American Bosch Magneto Corporation. These meetings, which are part of a business expansion program now being conducted by United American Bosch Corporation, were well attended, and Mr. Waker reported a great interest on the part of station owners, many of whom traveled hundreds of miles to attend. During the trip, which included stops at Denver, Kansas City and other points, Mr. Waker was impressed with unmistakable signs of business improvement. L. Vollmar, factory engineer, made that part of the tour which took in the Pacific coast meetings. No changes have been made in the status of distributors and service stations formerly operating under the combining companies. United American Bosch is now the sole American sales representative for Bosch products manufactured by Robert Bosch, A. G., of Stuttgart, Germany, in addition to American Bosch products made in the Springfield, Mass., plant.

James E. Redman, General Sales Manager, United American Bosch Corp.

Announcement

On March 4 a decree of the federal court was issued placing the Good Roads Machinery Co. in a receivership in equity. Earle S. Philips and Robert V. Bolger were appointed by the court as co-receivers to continue to operate the business. The receivership was a friendly one and was entered into with the idea of effecting a reorganization at the earliest possible date.

Mr. Philips has been vice-president and general manager of the Good Roads Machinery Company for several years and it is felt that the present action will be advantageous to all parties concerned. The company is solvent and it is hoped will be able to take care of all obligations at a very early date.

H. G. Gass Co. Covering New England for O. K. Clutch

Henry Druschel, manager of the O. K. Clutch and Machinery Company of Columbia, Pa., manufacturers of gasoline and electric compressors and hoists, recently announced the appointment of the Herbert G. Gass Company, 207 Main St., Greenfield, Mass., as distributor to represent their products in the New England territory.

Mr. Gass will travel with a demonstrator compressor over the New England states and will appoint dealers and agents, as well as selling direct to the users of O. K. hoists, compressors and elevators.

Penn-Dixie Places Hunt in Charge at Des Moines

Recent announcement has been made by the Pennsylvania-Dixie Cement Corporation, of New York City, of the appointment of O. C. Hunt as sales manager in charge of the territory served by its Des Moines plant. Mr. Hunt's headquarters will be in the Insurance Exchange Building. R. J. Hild will continue as district sales manager.

Mr. Hunt has had wide experience in the building supply business and for more than sixteen years has been connected with the cement industry.

Announcement is also made that L. C. Currinder has joined Penn-Dixie's western staff and will be situated at the Des Moines headquarters of the company.

The Canton Culvert and Silo Company, of Canton, Ohio, manufacturers of corrugated culverts since 1908, have recently changed the name of their company to the Canton Culvert Company.

Service Exchange

For Manufacturers or Distributors

Editor's Note.—From time to time we receive letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment, or from manufacturers seeking representatives of their products. Items of this kind will be published and names and addresses furnished interested persons upon request.

New Lines Wanted

Sales engineer, experienced in earth-moving machinery, desires connection on salary or salary and commission basis. Wide acquaintance with machinery dealers, oil and gas industry, pipe-line contractors and material men. References.

Warehouse facilities for serving Pittsburgh territory. Would like to secure line of portable and stationary conveyors.

Wanted, agency for any type of building specialties or contractors' machinery except mixers. Twenty years' experience. Familiar with all types of contractors' machinery. Could act as sales manager for Atlantic coast line with dealers.

Distributor covering Wisconsin and Illinois territory wishes to add to present lines. Thoroughly familiar with bituminous materials and equipment for handling.

Distributor situated in Portland, Oregon, desires line of stationary diesel engines, from 75 to 150 hp., to serve western trade for driving rock crushers and industrial plants.

Wanted, line of street markers or other traffic equipment on exclusive basis by distributor covering New Jersey and New York territory.

Distributor situated in Virginia wishes to make connection to represent manufacturer of manganese crushing plates and jaw rock crushers.

Export manager for American manufacturer of road graders is in a position to handle an additional line of non-competing construction machinery, for manufacturer seeking foreign representation.

Manufacturer's representative situated in New York City, now handling pumping machinery, would like to take on two or three additional lines serving the same field as his present account.

Manufacturer's representative with 25 years' sales experience, conversant with all types of pumps and their field, desires agency for either New York or export territory or both.

Wanted, line of picks, sledges and crow bars, spades, shovels and similar implements by New Jersey broker, with warehouse facilities, contacting New York and New Jersey jobbers.

Representative in northwest desires to handle, on commission basis, line of road building and maintenance machinery, revolving scrapers, tractors, rotary snow plows and V-type push plows.

Manufacturer's representative, covering Massachusetts, Rhode Island and southern New Hampshire, would like to secure line of speed reducers and gears.

Wanted, exclusive sales right for state of Mississippi for line of automatic or self-loading wheeled scraper.

Equipment distributor in Pacific northwest desires line of road-building equipment, structural building equipment, dump bodies and truck hoists.

Wanted, for Buffalo, Niagra frontier and western New York territory, a good power and heating boiler account.

Distributor of building specialties covering territory of 100-mile radius from Chicago is equipped to represent additional lines.

Representatives Wanted

Manufacturer of air compressors and contractors' tools has number of desirable territories open. Full cooperation will be extended to distributors.

Southwest and middle-west distributors wanted by manufacturer of metal lath, corner beads, channels and reinforcing mesh.

Long established and well-known manufacturer of industrial locomotives wishes to make contacts with qualified distributors. Locomotive line includes steam, gasoline, gas-electric and oil-electric. Supported by national trade journal advertising.

Manufacturer of complete line street repair equipment, tar kettles, heaters, patching plants, torches, etc., has open territory in southeastern states and desires active distribution. Territory largely open from Virginia to gulf states, inclusive, also state of Oklahoma.

Eastern manufacturer of grade-rippers, scrapers and road hones has desirable territory open for distributors.

Manufacturer of asphalt ingredient adaptable for use in the road or industrial field, is seeking representatives for desirable territory in various parts of the country.

California territory available for distributor wishing paving expansion joint account.

Good, unassigned territory available for distributors and manufacturer's representatives to handle paving expansion joint line.

Manufacturer of transverse testing machines desires to build up distribution organization in this country and abroad.

Several desirable states open. Wanted, distributing organizations covering entire states by manufacturer of mechanical spreader.

Territory open in several states for representatives to handle grade-rippers, mechanical plows.

Manufacturer of steel dump bodies and oil heaters seeking distribution points in west central and southern states, including Missouri, Kansas, Iowa, Nebraska, Colorado, Kentucky, Tennessee, Mississippi, Arkansas, Louisiana and western half of Illinois.

Attractive territory open in states south and west of Chicago by manufacturer of cut-to-length, easily-erected standardized steel highway bridges, for spans up to and including 40 ft. Product sells to highway commissioners and superintendents.

Manufacturer of patented reflecting signs and devices desires representatives for New York City, Long Island, Westchester County and adjacent territory. Some one selling other products to municipalities preferred.

Manufacturer of special corrosion-preventing lubricant for road machinery and construction equipment wishes to establish distributing points throughout the country.

Manufacturer of metal tie and spacer wishes to establish distributing points throughout the country.

Manufacturer of contractors and builders levels and transits is seeking district sales manager. Exclusive contract given. Excellent territory still available. Backed by national advertising.

Well established manufacturers' representatives wanted to handle sand and gravel pumps and equipment, in key cities, by successful manufacturer of high grade dredging pumps and hydraulic dredging equipment. Give character of equipment now being handled and territory covered.

Manufacturer of complete line of construction equipment, mixers, saw rigs, plaster and mortar mixers and pumps has an open territory in the state of Maine and is looking for an aggressive distributor to represent him there.

Manufacturer of patented luminous highway danger signs and signals is interested in securing aggressive representation in various parts of this country and Canada.

One of the leading manufacturers of surveying instruments in the United States is seeking responsible agents in all sections of the country. Instruments are nationally advertised in all leading engineering journals.

Open territory in New York and New England states for aggressive distributor wishing to take on line of hoisting machinery and air compressors.

Manufacturer of nationally advertised construction equipment offers an excellent opportunity to experienced equipment salesmen to start in their own business. Very little capital required. Several important cities now open for immediate action. Full particulars. Address, Box 1637, c/o Roads and Streets, 420 Lexington Ave., New York City.

Hedge & Mattheis Co., equipment distributors of Portland, Me., have moved into their new offices and warehouse at 105 Preble St., according to recent information received from Arthur H. Morgan, manager.

USEFUL EQUIPMENT INFORMATION

Ready Mixed Concrete.—A new booklet of interest to contractors and building supply dealers has been issued by the Autocar Co., Ardmore, Pa. It bears the caption, "Concrete Mixers Mounted on Autocar Chasses." It is strictly technical in character, assembling in convenient form engineering drawings and essential information in reference to the installation of various specific types of mixer bodies on Autocar chasses. Copies of "Autocars for Hauling Building Materials," published in January 1931, and containing promotional matter on Autocars for hauling concrete, may likewise be had on request to the Autocar Co.

Emulsified Asphalts.—Bulletins 230, 330 and 430 of the Headley Emulsified Products Co., Philadelphia, Pa., are devoted to applications of Headley Emulsified Asphalts for waterproofing and dampproofing, and to Headley asphalt base aluminum coating. They may be secured upon application.

Concrete Curing.—A booklet, dealing with the curing of concrete by the Hunt process—a method of curing without the use of earth and water, is available for distribution by McEverlast, Inc., Los Angeles, Calif.

Traffic Treads.—Traffic treads and floor plates are described in two bulletins issued by the Alan Wood Steel Co., Conshohocken, Pa.

Resurfacing Worn Pavements. — The Texaco Co., New York, N. Y., will be glad to provide copies of "Worn Brick and Block Pavements," describing the use of Texaco asphalt for the repair of such surfaces.

Grading Equipment.—General catalog, No. 80, issued by the Western Wheeled Scraper Co., Aurora, Ill., is exceptionally attractive in form and interesting in contents. A copy will be sent to any earth mover on request. The catalog in its 144 pages, pictures and describes a very extensive line of grading tools and machines, giving special prominence to Western dump cars which are built in all practical sizes, both drop-door and lift-door types.

Fresnos, Snow Plows, Elevating Graders.—The Austin-Western Roads Machinery Co., Chicago, Ill., has issued recently bulletins covering its Western rotary fresnos, Western snow plows for Ford and Chevrolet trucks, and the new Western No. 6 elevating grader.

Gyratory Crushers. — The Allis-Chalmers Superior McCully fine-reduction gyratory crusher is described exhaustively in bulletin 1461-B issued by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Castings. — Municipal castings and street-drainage goods of the Guenther Foundry, Columbus, Ohio, are described in a recent folder.

Wheeled Scoops and Graders.—Broadside No. 3102 of the W. A. Riddell Co., Bucyrus, O., illustrates and describes Warco wheeled scoops. These scoops are designed for operation in trains of three or four depending upon the size of the pulling tractor. Circular No. 3103 illustrates and describes the new line of Warco rear control power graders for use with McCormick-Deering Industrial model 20, Fordson, Case model CI, or Allis-Chalmers Ind"U"strial tractor power.

Traffic Signal.—The American Gas Accumulator Co. of Elizabeth, N. J., describe in detail in its new literature a new reflector color signal which gives an indication at night of either red or amber to the driver of an approaching vehicle by reflecting the light from his headlamps. It is explained that it has over 70 sq. in. of reflected or luminous area and that the arrangement of six pyramidal type reflector elements in a hexagonal pattern is not like any other light pattern on the road.

Power Drag Scrapers.—Catalog No. 14 just issued by Sauerman Bros., Inc., Chicago, Ill., is a very complete reference book on the excavation and moving of materials with power drag scrapers. This catalog is a book of 72 pages with almost 200 illustrations of equipment details and of installations showing the great variety of work for which drag scrapers are suited. Installation photographs are grouped into sections that provide detailed information on each of the general classifications of drag scraper uses. An entirely new section on tower machines has been added, showing the use of this equipment for the construction of levees and embankments or for any channel or reservoir excavations and the like where the scraper must make long continuous cuts or long continuous fills.

Concrete Admixture.—The Colloy Products Co., St. Louis, Mo., has issued a circular (Form 201-C), describing Colloy, a colloidal type, inert workability admixture for concrete.

Retread and Road-Mix Methods.—The construction and reconstruction of road surfaces by the retread and road-mix using Bitumuls HRM, a cold bituminous binder, is described in Bulletin No. 3, issued recently by the American Bitumals Co., San Francisco, Calif. Illustrations and descriptions of several jobs are given.

Gravel Plant.—A new broadside just issued by the Pioneer Gravel Equipment Mfg. Co., illustrates and describes the 1931 model Pioneer washing, screening, crushing and loading plant. This is a portable single unit plant for producing washed crushed crushed gravel and sand. Another broadside also just issued illustrates and describes the Pioneer Duplex screening, crushing and loading plant.

Crushers.—Bulletin No. 263 just issued by the Smith Engineering Works, Milwaukee, Wis., describes at length a new Telsmith cone crusher. The features of this new product are described, and capacities, weights, power requirements and dimensions are given.

Colas. — "Colas Specifications," "The Maintenance of Estate Drives and Paths" and "The Preservation of Wood Paving" are publications which may be secured from Flintkote Roads, Inc., New York, N. Y.

Street and Warning Signs.—Catalog 29 of the Municipal Street Sign Co., New York, N. Y., describes various types of signs for municipal and highway use.

Pipe Culverts for Highways. — Employment of cast iron for culvert pipe is treated in a publication issued by the United States Pipe and Foundry Co. of Burlington, N. J. The book discusses strengths, life, sizes, length, underfill and installation of cast iron culverts. Pictures at the end show typical installations. Information relative to the use of cast iron culverts is rather meager. This booklet gives some of the latest information obtainable.

Construction Equipment. — Catalogs dealing with Rex chain belt equipment are ready for distribution by the Chain Belt Co., Milwaukee, Wis. Catalog No. 204 deals with Rex building mixers, Rex pumps, Rex saw rigs, Rex plaster and mortar mixers. Catalog No. 206 illustrates the Rex champion paver and road pump for 1931. Chain Belt Co. is announcing something entirely new in Catalog No. 205, entitled "Rex Concrete Factories". It deals with three types of concrete factories—wet, dry, and shrinkage! It gives complete information on Rex moto-mixers for dry plants—Rex moto remixers for shrinkage plants and Rex moto agitators for wet plants. This book also gives engineering data on Rex elevators and Rex Stearns belt conveyors for concrete factories of all types.

Power Shovels and Cranes.—New publications just issued by Bay City Shovels, Inc., Bay City, Mich., includes the following: Bulletin 33—pocket dictionary of power shovels and cranes, illustrating with specifications, six Bay City models of convertible power shovels, cranes and excavators ranging from ¾ to 1 cu. yd. capacity. Catalog RS-4—20 pages and cover. Complete specifications and data, covering Bay City full revolving Model R, ¾-yd. shovel 12-ton crane; and Model S, 1-yd. shovel and 17½-ton crane, with convertible attachments and full crawler mounting.

Pipe Bending.—Bulletin 50 just issued by the A. M. Byers Co., Pittsburgh, Pa., covers the practice and theory of bending wrought iron pipe.

By writing the manufacturers named and mentioning this magazine, copies of the catalogs listed above will be sent you without obligation.